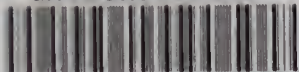


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Public Draft EIR
October 6, 2009

Draft
Environmental Impact Report
Volume 1

San Francisco Public Utilities Commission
**CALAVERAS DAM
REPLACEMENT PROJECT**



San Francisco Planning Department File No. 2005.0161E
State Clearinghouse No. 2005102102

Public Draft EIR Publication Date: October 6, 2009

Draft EIR Public Hearing Date:

November 10, 2009 in East Bay

November 12, 2009 in San Francisco

Draft EIR Public Comment Period: October 6, 2009 through November 20, 2009

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PUBLIC NOTICE

Notice of Availability of Draft Environmental Impact Report for the Calaveras Dam Replacement Project Notice of Public Meetings Planning Department Case No. 2005.0161E State Clearinghouse No. 2005102102

A Draft Environmental Impact Report (EIR) has been prepared by the San Francisco Planning Department in connection with this project. The report is available for public review and comment at the following locations:

- Online at: www.sfgov.org/site/planning/mea
- In print at:
 - San Francisco Planning Department offices at 1660 Mission Street, 1st Floor Planning Information Counter. (DEIR only)
 - By appointment at the San Francisco Planning Department offices at 1650 Mission Street 4th Floor (call 415-558-6378). (DEIR and reference materials)
 - The public libraries listed below (DEIR only)

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Fremont, California 94538

San Francisco County
San Francisco Main Library
100 Larkin Street
San Francisco, California 94102

Santa Clara County
San Jose-Dr.Martin Luther King Jr. Library
150 E. San Fernando Street
San Jose, California 95112

Project Description

The San Francisco Public Utilities Commission (SFPUC) is proposing a project to replace the existing Calaveras Dam. Calaveras Dam and Reservoir are part of the regional water system owned and operated by the City and County of San Francisco, through the SFPUC. Calaveras Dam is located on Calaveras Creek in the Diablo Mountain Range in Alameda County, California, approximately 12 miles south of the City of Pleasanton and 7.5 miles east of the City of Fremont. Calaveras Dam forms Calaveras Reservoir, which is situated on the border between Alameda and Santa Clara Counties.

Beginning in the winter of 2001, the SFPUC lowered water levels in the reservoir in response to safety concerns about the seismic stability of the dam. A mandate from the California Department of Water Resources, Division of Safety of Dams (DSOD) directed the SFPUC to undertake necessary seismic improvements to the dam and lower the reservoir water level until these improvements are completed. The elevation of the lowered water level corresponds to about 38,100 acre-feet (AF) of storage, which is approximately 60 percent less than the pre-DSOD restricted total water storage volume.

The SFPUC proposes to construct a new dam to replace the existing Calaveras Dam. The replacement dam, to be located immediately downstream at the foot of the existing dam, would respond to DSOD requirements to improve seismic safety. Replacement of the dam would allow

the reservoir to be filled to its former volume of about 96,850 AF. This would restore the previously existing yield and reliability of the SFPUC local system and provide water supply during droughts.

The main elements of the proposed project are as follows:

- Construct a new earth and rockfill dam with a robust design that could accommodate potential enlargement by future generations, and modification of the existing dam to accommodate the construction and operation of the new replacement dam;
- Remove the existing spillway and construct an ungated spillway with a concrete-lined channel and a new stilling basin;
- Remove the existing intake tower, plug the shaft, and construct a new intake tower and shaft connecting to an existing drain and three water inlet adits;
- Extend the outlet pipe connecting to a relocated, fixed cone valve, and install new low-flow discharge valves for fishery releases;
- Install instrumentation such as piezometers, inclinometers, settlement monuments, seepage weirs, and accelerometers to measure strong ground motions during earthquakes;
- Stabilize the right abutment landslide;
- Construct a bypass tunnel through the Alameda Creek Diversion Dam to improve habitat conditions in Alameda Creek downstream of the diversion; and
- Implement flow releases to support native fishes in Calaveras and Alameda Creeks downstream of Calaveras Dam and the Alameda Creek Diversion Dam.

Construction would begin in spring 2011 and would be completed in approximately 4 years.

Summary of Impacts

Potential environmental impacts from the proposed project would result generally from three primary aspects of the project: construction activity; restoration of the reservoir water level to pre-DSOD restriction levels; and future reservoir operations, in particular as they affect flows within Alameda Creek downstream of the Alameda Creek Diversion Dam, and Calaveras Creek below Calaveras Dam.

This Draft EIR identifies that significant impacts may occur on recreation; vegetation and wildlife; air quality; fisheries and aquatic habitat; water quality; geology, soils and seismicity; hazards and hazardous materials; cultural resources; visual resources; transportation and circulation; noise; and energy resources. While most project impacts could be mitigated to less-than-significant levels, the EIR concludes that the project would have significant unavoidable impacts (i.e., significant impacts that could not be mitigated to a level of less than significant) with regard to visual resources and construction-related transportation and nighttime noise. The EIR also concludes that, while the impacts of emissions of ozone precursors and greenhouse gases during construction could be mitigated to less-than-significant levels under currently applicable thresholds of significance, these impacts would be significant and unavoidable in accordance with newly proposed draft CEQA Guidelines under consideration by the Bay Area Air Quality Management District.

The proposed project would include work near the former Calaveras Test Site at the end of Marsh Road which is listed in the California Regional Water Quality Control Board, San Francisco Bay

Region (RWQCB) Spills, Leaks, Investigations, and Cleanup (SLIC) database. The RWQCB has required cleanup (or remediation) of historic releases of hazardous materials at this site.

This Draft EIR tiers from the Program EIR prepared for the SFPUC's Water System Improvement Program (WSIP), State Clearinghouse No. 2005092026, available for review at the San Francisco Planning Department, 1650 Mission Street, San Francisco, CA 94103 and online at www.sfgov.org/site/planning/mea. As a component of the WSIP, it contributes to the impacts that the WSIP, as a program, may have on the environment. This Draft EIR incorporates by reference the relevant analyses of the Program EIR with respect to the WSIP's impacts and mitigation measures, as applicable to this project.

Public Hearings

The San Francisco Planning Department will hold two public hearings on this Draft EIR. A **public hearing** on this Draft EIR will be held on: **Tuesday, November 10, 2009**, at the Fremont Main Library, 2400 Stevenson Blvd, Fremont, beginning at 6:30 p.m. A public hearing on this Draft EIR and other matters has been scheduled by the City Planning Commission for **Thursday, November 12, 2009**, in Room 400, City Hall, 1 Dr. Carlton B. Goodlett Place, San Francisco, CA 94102, beginning at 1:30 p.m. or later. (Call 415-558-6422 the week of the hearing for a recorded message giving a more specific time.)

Public Comments

Public comments on the Draft EIR will be accepted by the San Francisco Planning Department from **Tuesday, October 6, 2009** until **Friday, November 20, 2009**, at 5:00 p.m. You may submit comments to the Planning Department using any of the following means:

- Provide oral or written comments at either of the two public hearings;
- Mail written comments to Bill Wycko, Environmental Review Officer, San Francisco, Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103,
- Fax written comments to 415-558-6409, or
- Email written comments to chris.kern@sfgov.org.

Comments received at the public hearing and in writing will be responded to subsequently in a Comments and Responses document. If you have any questions about the **environmental review** of the proposed project, please call the EIR Coordinator, Chris Kern, at 415-575-9037.



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CALAVERAS DAM REPLACEMENT PROJECT ENVIRONMENTAL IMPACT REPORT

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ABAG	Association of Bay Area Governments
AC Transit	Alameda County Transit
ACA	Alameda Creek Alliance
ACDD	Alameda Creek Diversion Dam
ACFCWCD	Alameda County Flood Control and Water Conservation District
ACFD	Alameda County Fire Department
ACFRW	Alameda Creek Fisheries Restoration Workgroup
ACHP	Advisory Council on Historic Preservation
ACPWA	Alameda County Public Works Agency
ACSO	Alameda County Sheriff's Office
ACWD	Alameda County Water District
ADLL	Arroyo de la Laguna
ADRR	Archaeological Data Recovery Report
AEER	Archaeological Evaluation and Effects Report
AEP	Archaeological Evaluation Plan
AF	acre-feet
AFY	acre-feet per year
AMP	archaeological monitoring plan
APCO	Air Pollution Control Officer
APN	Assessor's Parcel Number
ARDTP	Archaeological Research Design and Treatments Plan
ART	Archaeological Resources Technology
ASCE	American Society of Civil Engineers
ASR	Archaeological Survey Report
ATCM	Airborne Toxics Control Measure
AWHCP	Alameda Watershed Habitat Conservation Plan
B	Beneficial
B.P.	Before Present
BAAQMD	Bay Area Air Quality Management District
BACT	best available control technology
BAOS	Bay Area Ozone Strategy
BART	Bay Area Rapid Transit
BAWSCA	Bay Area Water Supply and Conservation Agency
BMI	benthic macroinvertebrate
BMPs	Best Management Practices
BSD	black spot disease
BSSC	Building Seismic Safety Council
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CAAQS	California ambient air quality standards
CalEPA	California Environmental Protection Agency
Cal/OSHA	California Division of Occupational Safety and Health
Caltrans	California Department of Transportation
CAP	Clean Air Plan
CARB	California Air Resources Board

CASQA	California Storm Water Quality Association
CBC	California Building Code
CCAA	California Clean Air Act
CCAR	California Climate Action Registry
CCAT	California Climate Action Team
CCC	Central California Coast
CCR	California Code of Regulations
CCSF	City and County of San Francisco
CCTS	Central California Taxonomic System
CDC	California Department of Conservation
CDF	California Department of Forestry and Fire Prevention
CDFG	California Department of Fish and Game
CDRP	Calaveras Dam Replacement Project
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
CH ₄	methane
CHSC	California Health and Safety Code
CHRIS	California Historical Resources Information System
CMA	congestion management agency
CMP	Congestion Management Program
CNDDb	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	CO ₂ equivalent
CRHR	California Register of Historical Resources
CTAP	Calaveras Technical Advisory Panel
CTR	California Toxics Rule
CTS	California tiger salamander
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel
dbh	Diameter at breast height
DEHP	di (2 ethylhexyl) phthalate
DIS	(California Department of Industrial Relations) Division of Industrial Safety
DMP	dust mitigation plan
DO	dissolved oxygen
DPM	diesel particulate matter
DPS	distinct population segment
DSOD	(California Department of Water Resources) Division of Safety of Dams
DTSC	(California) Department of Toxic Substances Control
DWR	(California) Department of Water Resources

EAM	Early action measure
EBRPD	East Bay Regional Park District
ECAP	East County Area Plan
ESZ	Ecological Sensitivity Zone
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMS	emergency medical services
ERO	Environmental Review Officer
ESA	Endangered Species Act
ESZ	Ecological Sensitivity Zone
ETJV	EDAW & Turnstone Joint Venture
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
fps	feet per second
ft/ft	foot/foot
FWCA	Fish and Wildlife Coordination Act
g	acceleration of gravity
GHGs	greenhouse gas
GIS	Geographic Information System
GLO	General Land Office
GWP	global warming potential
HAP	hazardous air pollutant
HASP	Health and Safety Plan
HCASR	Historic Context and Archaeological Survey Report
HCP	Habitat Conservation Plan
HH/LSM	Hetch Hetchy/Local Simulation Model
HOS	hypolimnetic oxygenation system
HOV	High Occupancy Vehicle
HRIER	Historic Resources Inventory Evaluation Report
HRP	Habitat Reserve Program
HRSA	Health Risk Screening Analysis
HVAC	heating, ventilating, and air conditioning
I-80	Interstate 80
I-280	Interstate 280
I-580	Interstate 580
I-680	Interstate 680
IC	incident command
in/sec	inches per second
kV	kilovolt
kWh	kilowatt hours
Lb/day	pounds per day
L _{dn}	day-night noise level
LED	light emitting diode
LEED	Leadership in Energy and Environmental Design

L _{eq}	steady-state energy level
L _{eq} (24)	steady-state energy level measured over a 24-hour period
L ₁₀	the noise level that is exceeded during 10 percent of the measurement period
lf	linear feet
L _{max}	maximum noise level
LOS	Level of Service
LS	less than significant
LSM	less than significant with mitigation
M	moment magnitude
MACT	maximum available control technology
MBTA	Migratory Bird Treaty Act
MCE	Maximum Credible Earthquake
MCL	Maximum Contaminant Level for Drinking Water
MCY	million cubic yards
MEA	San Francisco Planning Department Major Environmental Analysis Division
MECA	Mayor's Energy Conservation Account
MEI	Maximally Exposed Individual
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mgd	million gallons per day
MLD	Most Likely Descendant
mm/yr	millimeters per year
MMT	million metric tons
MMTCO ₂ -e	million metric tons of CO ₂ e
MOU	Memorandum of Understanding
mph	miles per hour
msl	mean sea level
MT	metric tons
MTC	Metropolitan Transportation Commission
MTU	(Cal/OSHA) Mining and Tunnel Unit
NAAQS	national ambient air quality standards
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NESHAP	national emissions standards for hazardous air pollutants
NHPA	National Historic Preservation Act
NI	no impact
NIOSH	National Institute of Occupational Safety and Health
NIT	New Irvington Tunnel
NMFS	National Marine Fisheries Service
NMHC	non-methane hydrocarbon
N ₂ O	nitrous oxide
NO	nitric oxide
NO ₂	nitrogen dioxide
NO ₃	nitrate
NOA	naturally occurring asbestos
NOP	Notice of Preparation
NO _x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System

NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTR	National Toxics Rule
NTU	nephelometric turbidity units
NWIC	Northwest Information Center
OAP	Ozone Attainment Plan
OES	(California) Office of Emergency Services
OHWM	ordinary high water mark
OPR	(State) Office of Planning and Research
PAH	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	primary constituent element
PCM	phase contrast microscopy
PEIR	Program Environmental Impact Report
PEL	permissible exposure limit
PFMC	Pacific Fishery Management Council
PG&E	Pacific Gas and Electric Company
PM	particulate matter
PM ₁₀	fine particulate matter 10 microns or less in diameter
PM _{2.5}	fine particulate matter 2.5 microns or less in diameter
PMF	Probable Maximum Flood event
PMP	Probable Maximum Precipitation event
ppb	parts per billion
ppm	parts per million
PPV	peak particle velocity
PRC	(California) Public Resources Code
PSM	potentially significant mitigable
PSU	potentially significant unavoidable
PTSF	percent time spent following
PV	photovoltaic
QA/QC	Quality Assurance/Quality Control
QI	Quantic Industries
REB	Resource Efficient Building
ROG	reactive organic gases
RWQCB	Regional Water Quality Control Board
SABPL	San Antonio Backup Pipeline
SAPS	San Antonio Pump Station
SARHOS	San Antonio Reservoir Hypolimnetic Oxygenation System
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition (remote computerized operations system)
SCCFD	Santa Clara County Fire Department
SCCSO	Santa Clara County Sheriff's Office
SCMA	South Calaveras Mitigation Area
SFBAAB	San Francisco Bay Area Air Basin
SFPUC	San Francisco Public Utilities Commission

SFWD	San Francisco Water Department
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SLIC	Spills, Leaks, Investigations, and Cleanup
SMARA	Surface Mining and Reclamation Act
SO ₂	sulfur dioxide
SOS	Space Ordnance Systems
SRA	(California) State Responsibility Area
SRI	Stanford Research Institute
STLC	soluble threshold limit concentration
SU	significant unavoidable
SVP	Society of Vertebrate Paleontology
SVVFD	Spring Valley Volunteer Fire Department
SVWC	Spring Valley Water Company
SVWTP	Sunol Valley Water Treatment Plant
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Toxic Air Contaminant
T-BACT	best available control technology for TACs
TDS	Total Dissolved Solids
TEM	transmission electron microscopy
TMDL	total maximum daily load
TPY	tons per year
TSO	Tunnel Safety Orders
UACFGP	Upper Alameda Creek Filter Gallery Project
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VACC	Vibro-Acoustic Consultants
VMT	vehicle miles traveled
VTa	Santa Clara Valley Transportation Authority
WDR	Waste Discharge Requirement
WEIP	Watershed and Environmental Improvement Program
WMP	(Alameda) Watershed Management Plan
WSIP	Water System Improvement Program

Other Abbreviations

μm	micrometers
μm/m ³	micrometers per cubic meter
μg/kg	micrograms per kilogram
μg/L	micrograms per liter
μmhos/cm	micro-mhos per centimeter
°C	degrees Celsius
°F	degrees Fahrenheit

GLOSSARY

abutment:	The point where the side of the dam meets the existing undisturbed earth or rock foundation material.
accelerometer:	A device used to measure ground motion during an earthquake.
acre-foot:	The quantity of water required to cover 1 acre to a depth of 1 foot. Equal to 43,560 cubic feet or 325,851 gallons.
active fault:	(a) A fault on which significant subsurface earthquake activity or any surface ground breakage has occurred in the last 11,000 years. (b) A fault that has the potential for displacement in the present tectonic environment. California Division of Safety of Dams (DSOD) requires fault activity be based on fault rupture event within the past 35,000 years.
adit:	A horizontal opening into the vertical intake shaft.
aggradation:	The process of deposition of sediment at a site, typically a stream channel.
aggrade:	To raise the grade or level of (a river valley, a stream bed, etc.) by depositing detritus, sediment, or the like.
alluvial fan:	A fan-shaped deposit formed where a fast flowing stream flattens, slows, and spreads typically at the exit of a canyon onto a flatter plain.
alluvium:	Unconsolidated mixture of gravel, sand, clay, and silt typically deposited by streams.
ammocoete:	Larval stage of a lamprey (an anadromous eel).
anadromous:	Fish that are hatched in freshwater, live some or all of their adult lives in saltwater, and migrate back to freshwater to reproduce (e.g., salmon, steelhead).
anoxia:	Low-oxygen conditions within the hypolimnion (bottom) of a thermally stratified reservoir.
aquifer:	Permeable subsurface materials (soil, sediments, and rock) that contain groundwater. Aquifers may be large or small, local or regional, shallow or deep, and confined or unconfined, depending on the subsurface geologic conditions. The permeable materials that surround an unconfined aquifer allow the water table to fluctuate in response to recharge (precipitation in the wet season) and discharge (evapotranspiration in the dry season). A confined aquifer is contained within impermeable materials and, as a result, the water table does not fluctuate.

asbestos:	A term used for several types of naturally occurring fibrous minerals found in many parts of California, some of which have been found to be cancer-causing agents.
aseismic:	Measurable surface displacement along a fault in the absence of notable earthquakes.
avulsion:	Erosion of a stream channel during periods of high flow.
axis:	The vertical plane that extends from the left abutment to the right abutment through the center of the core of the dam.
base flow:	Sustained flow of a stream without direct runoff during precipitation events. It includes natural and human-induced stream flows. Natural base flow is sustained largely by ground-water discharges.
bathymetric:	Measurement of the depth of the reservoir.
bedload:	Sediment, gravel, cobbles, and rocks transported along the stream bed by moving water (as opposed to suspended in the stream flow).
bedrock units:	The consolidated rock underlying the surface. It may be covered with deposits of unconsolidated material such as soil or broken and weathered rock.
beneficial use:	Uses of water as defined in the State of California Water Code (Chapter 10 of Part 2 of Division 2), including, but not limited to, agricultural, domestic, municipal, industrial, power generation, fish and wildlife habitat, recreation, and mining.
berm:	A low earthen wall adjacent to a ditch. Used to control erosion and sedimentation by slowing the flow of surface runoff.
bifurcation:	Divided into two parts.
blueschist:	A metamorphic rock formed under condition of high pressure and relatively low temperature, often containing the blue minerals glaucophane and kyanite.
bolting:	A technique used to reinforce unstable rock walls by inserting bolts into the rock and tightening them to compress the rock.
borrow area:	An area of excavation for geologic materials, e.g., a quarry.
braided:	A stream that divides into an interlacing or tangled network of several branching and reunited channels separated from each other by branch islands or channel bars. Typically highly changeable with different flows.
buttress:	An earthwork built at the base of a hill to prevent the earth above from sliding downward.

bypass flow:	Water flow that is allowed to pass a diversion in stream or reservoir rather than being diverted out of the stream flow or reservoir.
canopy cover:	The vegetation that projects over a stream. Can arbitrarily be divided into two levels: Crown cover is more than three feet (1 m) above the water surface. Overhang cover is less than three feet (1 m) above the water surface.
cascade:	A waterfall or a series of waterfalls.
Cenozoic:	The latest of the four eras into which geologic time is divided; it extends from the close of the Mesozoic Era, about 65 million years ago, to the present.
chert:	A common hard, fine-grained silica-rich cryptocrystalline sedimentary rock that may contain small fossils.
chute:	An inclined trough, passage, or channel feature through or down which things may pass. A waterfall or rapid.
cofferdam:	A temporary structure to keep water away from a construction site.
coliform:	Coliform bacteria are a commonly-used bacterial indicator of sanitary quality of water. Coliforms are naturally present in the environment; as well as feces; fecal coliforms and E. coli only come from human and animal fecal waste.
colluvium:	A loose deposit of rock debris accumulated through the action of gravity on a slope, e.g., at the base of a cliff.
concrete aggregate:	Concrete that contains inert granular materials such as sand, gravel, or crushed stone.
cone valve:	A valve for controlling flow from a pipe. A plug is inserted into the upstream end of the pipe to shut off the flow.
confluence:	A juncture where two or more streams or rivers flow together.
conglomerate:	A coarse-grained, clastic sedimentary rock composed of rounded fragments larger than 2 mm in diameter set in a fine-grained matrix.
coniferous:	Trees that are cone-bearing, usually evergreens.
creep:	Slow ground displacement along a fault usually occurring without accompanying earthquakes (see "aseismic").
Cretaceous age:	The final period of the Mesozoic Era thought to have covered the span of time between 135 and 65 million years ago. Also the system of strata deposited during that period.

criteria air pollutant:	Certain air pollutants for which the federal and state authorities have established specific standards of exposure to protect the public health and welfare.
culvert:	A drainage structure under a road or embankment.
dam crest:	Highest elevation on the dam.
datum:	A line, point, or surface (such as sea level) used as a reference for measuring elevation.
dBA:	The dBA, or A-weighted decibel, refers to a scale of noise measurement that approximates the range of sensitivity of the human ear to sounds of different frequencies.
deadpool:	The lowest level to which the reservoir can be lowered, typically determined by the level of the lowest intake adit.
deciduous:	Trees that loose their leaves in winter.
dextral fault:	A right lateral fault (see right lateral).
discharge channel:	A declivity in the ground surface into which waters are directed.
disinfection:	Destruction of microbial pathogens in the water supply.
diversion dam:	A dam which impounds water for purposes of directing stream flow from the main channel.
diversion gates:	An engineering device that allows stream water to flow into a diversion channel or other conveyance structure.
diversion tunnel:	A tunnel used to carry diverted water.
downgradient:	A location at lower elevation than the reference point.
drainage basin:	The generally large topographic area in which runoff is collected and concentrated into a system of streams.
drawdown:	The lowering of the level of a water body, such as a reservoir or a groundwater basin.
easement:	A legal right to cross a land parcel belonging to another party, e.g. a pipeline easement, or a power line easement.
ecosystem:	The complex of organisms and their environment in a given geographic area with a distinctive structure and functional systems.
ecotone:	A transition area between two adjacent ecological communities.

electrical conductivity:	Electrical conductivity is a measure of the amount of salts in the water. See also micro-mhos as a measure of electrical conductivity.
emergent vegetation:	Vegetation in or along the edge of a water body in which the root system is underwater and the plant body (stems, leaves, etc.) are above water.
embankment:	A natural or artificial slope comprised of earth, concrete or other material.
en-echelon:	Geologic features (usually faults) that are in an overlapping or staggered arrangement.
endemic:	Referring to local or natural conditions in the environment.
enhancement of fisheries:	Protection and improvement of fishery habitat, including augmentation of stream flows during certain times of the year.
entrainment:	The incidental trapping of fish and other aquatic organisms at an intake (for example, at water and/or irrigation diversions and power plant cooling water intakes).
Eocene:	An epoch of the Tertiary period (see "Tertiary Age") thought to span 45 to 38 million years before present.
ephemeral streams:	Streams that flow briefly during and immediately following storm events.
epilimnion:	The top-most layer in a thermally stratified reservoir, occurring above the deeper hypolimnion. It is warmer and typically has a higher pH and dissolved oxygen concentration than the hypolimnion.
estuarine:	Referring to environments with shared characteristics of both fresh water and salt water conditions, typically in a bay.
eutrophic:	Having waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content.
fault zone:	A zone in which there are a number of more or less closely spaced faults.
firm yield:	See "system firm yield"
fish passage:	Stream conditions that allow fish to move freely, as in a migration.
fish screen:	Barrier on the front face of a water intake to prevent the entrainment of fish and debris into the water supply.

floodplain:	Land adjacent to a watercourse over which water flows in times of flood. The limits of the flood plain are defined by the peak level of a 1 in 100 year return period flood.
foliation:	A planar arrangement of textural or structural features in metamorphic rock.
fracture:	Any break in a rock, whether or not it causes displacement, due to mechanical failure by stress.
freeboard:	The vertical distance from the spillway crest to the dam crest.
fry:	Early stage of development in salmon or trout. During this stage, the young fish has hatched from the egg, has absorbed its yolk sac, is living in the stream, and is less than one year old.
fugitive dust:	Fugitive emissions are released to the atmosphere by some means other than through a stack or tailpipe.
geomorphology:	The study of landforms and the processes that create them, e.g., erosion, sediment transport, sediment deposition, slope processes and others.
glide:	A slow-moving shallow run (see also “run”).
graywacke:	Dark gray, firmly indurated coarse-grained sandstone that consists of poorly sorted angular to subangular grains of quartz and feldspar, with a variety of dark rock and mineral fragments, embedded in a compact clayey matrix.
greenstone:	Altered or metamorphosed basic igneous rock, typically volcanic rock.
groundwater:	Water in the ground held within soil material, fractures and other spaces in the rock.
grout:	A mixture of water, cement, and sand, or of various chemicals.
grouting:	Injection of grout through drilled holes, under pressure, to fill seams, fractures, or joints and thus seal off water inflows or consolidate fractured rock.
habitat:	The specific area or environment in which a particular type of animal or plant lives.
haul distance:	The linear distance over which material is transported.
headwaters:	The point or area of origin for a river or stream.
historically active:	Faults that have generated earthquakes accompanied by surface rupture during historic time (approximately the last 200 years) and faults that exhibit aseismic fault creep.

Holocene time:	Approximately the last 11,000 years.
hydraulic conductivity (Permeability Coefficient):	The rate of flow of water through a cross section of one square foot under a unit hydraulic gradient, at the prevailing temperature.
hydraulic head:	A measurement of water pressure or total energy per unit weight above a datum. It is usually measured as a water surface elevation, expressed in units of length, but represents the energy at the entrance (or bottom) of a piezometer. Hydraulic head can similarly be measured in a column of water using a standpipe piezometer by measuring the height of the water surface in the tube relative to a common datum. The hydraulic head measurement represents the total energy at the entrance (base) of the piezometer.
hydric soil types:	Soils that are generally wet most of the year and having low oxygen content.
hydrograph:	A chart that depicts certain water conditions over a given period of time.
hypolimnetic oxygenation system:	An engineered structure at the bottom of a reservoir or other water body that pumps oxygen into the water column.
hypolimnion:	The cool, dense bottom water layer in a reservoir that lies below the warmer, lighter epilimnion on the surface.
hydrologic year types:	The California Department of Water Resources defines rainfall year types relative to average hydrologic conditions, including rainfall, runoff, and snowmelt conditions, in order of decreasing availability of water: wet year, above-normal year, normal year, below-normal year, dry year, and critically dry year. Drought year refers to one year during consecutive dry or critically dry years.
hydrology:	The science that deals with the waters above and below the land surface; their occurrence, circulation, and distribution, both in time and space; their biological, chemical, and physical properties; and their reactions with their environment, including their relation to living beings.
hydrophytic vegetation:	Plant life growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.
hydroseed:	To sow (a field, lawn, etc.) with seed by distribution in a stream of water propelled through a hose.
igneous rock:	Rocks created by solidification of hot fluid material, e.g., volcanic material flowing and cooling on the earth surface (such as basalt) or magma material cooling within the crust of the earth (such as granite).

impoundment area:	An area of inundation behind a dam.
inactive:	Faults that show direct geologic evidence of inactivity during all of Quaternary time or longer.
inflow:	Water flowing into a water body, such as a lake, reservoir or stream, or through subsurface groundwater movement.
in-holding:	A property parcel surrounded by property owned by one other party.
intake shaft:	A structure to draw water from the reservoir.
interbed:	A bed, typically thin, of one kind of rock material occurring between or alternating with beds of another kind of rock.
intermittent stream:	A watercourse that flows only for part of the year and dries up part of the year.
isothermal:	Refers to constant temperature in the water column.
joint:	A surface of actual or potential fracture or parting in a rock, without displacement.
Jurassic age:	The middle of three periods comprising the Mesozoic Era thought to have covered the span of time between 190 and 135 million years ago. Also the system of strata deposited during that period.
kilowatt-hour:	The amount of energy equivalent to a power of 1000 watts (one kilowatt) running for 1 hour. An incandescent light bulb uses electrical energy at a rate of 25 to 100 watts.
landslide deposits:	A general term for a wide variety of slope wasting deposits involving the downslope movement under gravity and soil moisture of masses of soil and rock material, such as rock falls, deep rotational/translational failure of slopes, mudslides and shallow debris flows.
lateral spreading:	A phenomenon in which large blocks of intact, non-liquefied soil move downslope on a liquefied substrate of large aerial extent.
left abutment:	When looking downstream from the dam, this is the valley wall to the left on which the dam is placed.
limnology:	Scientific study of the physical and biological characteristics of inland bodies of water such as lakes and ponds.
linear feet:	A total length measured in feet along a straight or curved line.

liquefaction:	A phenomenon in which saturated granular sediments temporarily lose their shear strength during periods of earthquake-induced, strong groundshaking. The susceptibility of a site to liquefaction is a function of the depth, density, and water content of the granular sediments and the magnitude of earthquakes likely to affect the site.
lithology:	(a) The description of rocks. (b) The physical character of a rock.
loam:	Soil comprised of an approximately even distribution of clay, silt, sand, and organic material.
local water storage:	The total storage derived from local watershed sources in the Sunol Region including Calaveras Reservoir, inflow into San Antonio Reservoir, and groundwater (e.g., Sunol infiltration galleries).
local water yield:	Total yield derived from combined storage in the Sunol Region including Calaveras Reservoir, San Antonio Reservoir, and groundwater (e.g., Sunol infiltration galleries).
macro-invertebrate:	An invertebrate animal (without backbone) larger than 0.5 millimeter or large enough to be seen without magnification.
magnitude:	The moment magnitude scale was introduced in 1979 as a successor to the Richter scale and is used by seismologists to compare the energy released by earthquakes. The moment magnitude M_w is a dimensionless number. An increase of 1 step on this logarithmic scale corresponds to 31.6 times increase in the amount of energy released, and an increase of 2 steps corresponds to a 1000 times increase in energy.
manifold:	A device that divides the flow of water into two or more outlets.
Maximum Contaminant Level (MCL):	
	The highest level of a contaminant that is allowed in drinking water. The MCL is set as close to the maximum contaminant level goal (MCLG – see below) as is economically or technically feasible. While the MCL is higher than the MCLG, it is considered protective of human health. The MCL is established by the U.S. Environmental Protection Agency.
Maximum Contaminant Level goal (MCLG):	
	The level below which there is no known or expected health risk to human health.
MWAT:	Maximum weekly average temperature, a criterion for developing temperature regimes to protect fish.
mélange:	Generally a mixture of rock materials of differing sizes and types generally contained within a sheared matrix.

mesothelioma:	A form of cancer associated with ingestion or inhalation of certain types of asbestos. Serpentine rocks can contain the hazardous forms of the mineral asbestos.
mesotrophic:	Mesotrophic is a term applied to clear water lakes with beds of submerged aquatic plants and medium levels of nutrients and microbiological activity.
metamorphic rocks:	Rocks formed from original igneous or sedimentary rocks through alterations produced by pressure, heat or the infiltration of other materials at depth.
micro-mhos per centimeter (umhos/cm):	Units used when measuring electrical conductivity. umhos/cm is a rate at which a small electrical current flows through a solution.
Miocene:	An epoch in the early Tertiary period (See Tertiary), a period of time that extends from about 23.03 to 5.332 million years before the present.
mudstone:	The lithified equivalent of mud, a fine-grained sedimentary rock similar to shale but more massive.
nephelometric turbidity units (NTUs):	Units used to measure turbidity (or clarity) in water. The term Nephelometric refers to the way the instrument estimates how light is scattered by suspended particulate material in the water. This measurement generally provides a very good correlation with the concentration of particles in the water that affect clarity.
NGVD 1929 Datum:	All elevations of the reservoir for this EIR are identified in feet above the NGVD 1929 Datum. NGVD stands for National Geodetic Vertical Datum. A datum is a line, point, or surface (such as sea level) used as a reference for elevation.
nonattainment:	Refers to the status of an air basin in which certain federal or state criteria for air pollution are not met.
non-native species:	Plants and animals that have not evolved naturally in a subject habitat.
nutrient loading:	The introduction of nutrients such as nitrogen or phosphorus into the water.
100-year storm event:	A rainfall event that statistically has a one percent chance of occurring in any given year.
outflow:	Water discharging from a water body.

outlet conduit:	A pipe or other conveyance structure that removes water from a reservoir, lake, stream or other water body.
outlet works:	The structures and equipment that are used to make a controlled release of water from the reservoir. They include the adits, drain, intake shaft and tower, intake and release valves, and outlet pipeline.
oversummering:	Referring to fish and other aquatic species survival during the summer period.
ozone:	Gaseous substance that is a key component of smog.
ozone precursor:	Gaseous emissions that combine chemically in the atmosphere to form ozone.
peak flow:	The maximum instantaneous discharge for a stream at a specific location. Corresponds to the highest stage of a flood.
perennial:	Lasting all year long, generally in reference to stream flow.
pH:	pH is a measure of the acidity or alkalinity of the water or soil.
photosynthesis:	The process by which plants absorb solar energy and grow.
piezometer:	Any of several instruments for measuring the pressure of a fluid or the compressibility of a substance when subjected to such a pressure.
pipng:	A process by which underground water becomes concentrated and creates voids in the soil or fill material.
pocket water:	Aquatic habitat characterized by having turbulent runs and riffles cutting between boulders or other features with small pools.
pool:	Deeper areas of a stream with slow-moving water, often used by larger fish for cover.
pore-water pressure:	The pressure of fluids in the spaces between soil particles in the dam embankment.
potentially active:	Faults that show geologic evidence of movement during the Quaternary (approximately the last 1.6 million years).
predaceous:	Referring to predatory behavior.
primary active:	An active fault that is the controlling fault in an area.

Probable Maximum

Flood: The Probable Maximum Flood is the greatest flood that may be expected, taking into account all pertinent factors of location, meteorology, hydrology and terrain (United Nations 2007).

Probable Maximum**Precipitation**

event: Theoretically, the greatest depth of precipitation for a given duration that is physically possible over a given size storm area at a particular geographic location at a certain time of the year.

Quaternary: The second period of the Cenozoic era (following the Tertiary); is the geologic time period from the end of the Pliocene Epoch roughly 1.806 million years ago to the present. The Quaternary includes two geologic subdivisions: the Pleistocene and the Holocene Epochs.

ramping schedule: Flows released from the reservoir to improve habitat conditions for fish are increased and decreased gradually or “ramped” to reduce impacts caused by sudden changes in flow conditions (e.g., scouring of redds, stranding, etc.). The ramping schedule sets forth the minimum daily flow for each day during the increasing and decreasing flow periods.

reach: A linear segment of a stream or river.

recapture: Returning released water to the system past the point of benefit.

recruitment: The entry of new individual organisms into a population of plants or animals.

redd: A spawning nest made by a salmonid for laying eggs. The female salmonid creates the nest by undulating her tail and body against the substrate of a stream.

reservoir: An artificially impounded body of water.

respirable

particulate: Very small particles that can be inhaled into the lungs.

riffle: A shallow section in a stream where water is breaking over rocks or other partially submerged organic debris and producing surface agitation.

right abutment: When looking downstream from the dam, this is the valley wall to the right on which the dam is placed.

right-lateral: Displacement or offset along a fault such that, in plan view, the side opposite the observer appears displaced to the right.

riparian: The land adjacent to a natural watercourse such as a river or stream. Riparian areas support vegetation that provides important wildlife habitat, as well as important fish habitat when sufficient to overhang the bank.

riprap:	A layer of large pieces of rock placed on top of a surface to protect the surface from erosion.
rotational landslide:	A movement of earth in which the material remains more or less coherent and intact as it slides downhill over a failure plan, as opposed to loose incoherent movement of material like a debris flow or mudslide.
run:	The straight fast-moving section of a stream between riffles.
salmonid:	Salmon or trout.
scour:	The clearing and digging action of flowing water, especially the downward erosion caused by stream water in removing material (e.g., soil, rocks) from a channel bed or bank or around in-channel structures.
sedimentation:	Deposition of material suspended in a stream system, whether in suspension (suspended load) or on the bottom (bedload).
seine:	A process of capturing fish with a net held between two people.
serpentinite:	A rock comprised of one or more serpentine minerals. Minerals in this group are formed by serpentinization, a hydration and metamorphic transformation of ultramafic rock.
settlement monument:	A marker used to determine the degree to which the ground surface sinks as it compacts or is undermined by subsurface processes.
shaft:	Along narrow passage beneath the ground; may be vertical, inclined or horizontal.
shale:	A fine-grained sedimentary rock whose original constituents were clays or muds. Characterized by thin laminae breaking with an irregular curving fracture, often splintery and usually parallel to the bedding plane.
shear:	An action resulting from applied forces that causes or tends to cause two contiguous parts of a body to slide relative to each other in a direction parallel to their plane of contact. Also used to describe the resulting displacement.
siliceous schist:	Schist containing abundant free silica of either organic or inorganic origin.
siltation:	Sediment inflow from either erosion or from sediment carried into a water body by rivers and tributaries.
slope wash:	Soil and rock material moved downslope primarily by the action of gravity assisted by running water confined to a channel.

sluicing:	The procedure of washing accumulated sediments from behind a dam into downstream watercourses.
smolts:	Juvenile anadromous fish that have undergone the physiological changes necessary for them to migrate from freshwater streams to the ocean
smoltification:	Fish adaptation process from freshwater to saltwater.
soldier pile:	Wide flange steel H sections driven into the ground. Horizontal timbers are inserted behind the H pile flanges to make a retaining wall.
spawning:	Laying and fertilizing fish eggs in the process of reproduction.
spillway:	A dam structure below the crest of the dam over which water spills to ensure that the water level does not rise to the crest of the dam.
spillway crest:	Highest point on the spillway of a dam.
static stress:	A stress in which the force is constant or slowly increasing with time.
stilling basin:	A basin in which water coming from the spillway or other discharge device at high velocity is slowed thereby allowing it to drain off at lower velocity.
stratification:	Seasonal development of a steep temperature gradient in lakes. Cold water settles to the bottom and warmer water floats on top. This condition remains stable for several months each year until a seasonal change such as strong winds or high rate of inflow from runoff causes the upper and lower layers to become mixed.
streambed:	The bottom of a stream comprised of natural materials (sand, silt, clay, cobbles, boulders or artificial constructed materials.
strike-slip:	The component of the movement or slip that is parallel to the strike of the fault.
stringer:	A vein or filament of soil or rock, usually one of a number, that occurs within a disparate geologic matrix.
substrate:	Soil or the materials at the bottom of a lake or stream in which plants grow.
surcharge:	The process by which extra material is placed to add weight that will cause the underlying material to compress and compact. After sufficient settlement and compaction occurs, the extra material is removed.
swale:	Area where winter rain collects but does not stand as long as in vernal pools.
system firm yield:	The average annual water delivery that can be sustained by a water supply system throughout an extended drought.
tectonic:	Referring to geologic structural processes such as mountain-building.

Tertiary age:	One of the major divisions of the geologic timescale, lasting from the end of the Cretaceous (about 65 million years ago) to the start of the Quaternary (about 2 million years ago). Also the system of strata deposited during that period.
thermocline:	The thermocline is the transition layer between the isothermal (mixed) layer at the surface and the deep water layer. The definitions of these layers are based on temperature. In the thermocline, the temperature decreases rapidly from the mixed layer temperature to the much colder deep water temperature.
total dissolved solids (TDS):	TDS is that portion of solids in water that can pass through a 2 micron filter. The more minerals dissolved into the water the higher the total dissolved solids. TDS is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of presence of a broad array of chemical contaminants.
toxic air contaminant (TAC):	Hazardous air pollutants associated with adverse health effects.
toxicity reference value (TRV):	TRVs are water quality criteria or standards for the protection of aquatic organisms.
translational landslide:	Same as a rotational landslide.
trematodes:	Parasitic worms, commonly referred to as flukes.
trophic:	Referring to specified kinds of nutrition or feeding requirements of organisms.
turbidity:	Turbidity is a measure of the cloudiness or clarity of the water. Turbidity is the condition resulting from suspended solids in the water, including silts, clays, industrial wastes, sewage and plankton. Such particles absorb heat in the sunlight, thus raising water temperature, which in turn lowers dissolved oxygen levels. (See also NTUs as a measure of turbidity.)
unconformity:	(a) A break or gap in the geologic record. (b) The structural relationship between two groups of rocks that are not in normal succession; also, their surface contact.
unconsolidated alluvium:	Stream-laid earth materials that are loosely placed and incoherent.
upper incipient lethal temperature (UILT):	This is a common measure of thermal (i.e., temperature) tolerance for fish.

undercuts:	Natural, inadvertent or intentional excavation of a slope or embankment in which underlying material is removed more deeply than the overlying material, creating an unstable slope.
vernal pool:	Seasonal wetland formed in gently rolling terrain where the soil is underlain by a slowly permeable claypan or hardpan.
water release:	Impounded water which is purposefully allowed to flow over a dam.
water year:	The 12-month period from October 1 through September 30. Those dates are used in California to establish the typical beginning of the wet period. The water year is designated by the calendar year in which it ends (for example, the year ending September 30, 2006 is called the “2006 water year”.)
watershed:	A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.
weathering:	To undergo changes, such as the discoloration softening, crumbling, or pitting of rock surfaces brought about by exposure to the atmosphere and its agents.
weir:	A small obstruction or dam in a river or stream used to divert or control water flow. When uncontrolled, the weir is termed a fixed-crest weir; other weir types include broad-crested, sharp-crested, drowned, and submerged.
wetland:	Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

1. EXECUTIVE SUMMARY

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1.1 INTRODUCTION

This Environmental Impact Report (EIR) addresses the environmental impacts and related mitigation measures for the proposed Calaveras Dam Replacement Project (CDRP). The CDRP consists of the proposed replacement of the existing Calaveras Dam, modifications to the Alameda Creek Diversion Dam (ACDD) and the long-term operation and maintenance of these facilities. The CDRP is proposed by the San Francisco Public Utilities Commission (SFPUC).

Calaveras Dam and Reservoir are part of the regional water system owned and operated by the City and County of San Francisco, through the SFPUC. Calaveras Dam is located on Calaveras Creek in the Diablo Mountain Range in Alameda County, California, approximately 12 miles south of the City of Pleasanton and 7.5 miles east of the City of Fremont. Calaveras Dam forms Calaveras Reservoir, which is situated on the border between Alameda and Santa Clara Counties.

The SFPUC initiated studies in 1998 to evaluate the structural stability and performance of the dam during projected large earthquakes. The studies indicated that the dam does not meet current safety standards for large earthquakes. Beginning in the winter of 2001, the SFPUC lowered water levels in the reservoir in response to safety concerns about the seismic stability of the dam. A mandate from the California Department of Water Resources, Division of Safety of Dams (DSOD) directed the SFPUC to undertake necessary seismic improvements to the dam and lower the reservoir water level until these improvements are completed. The elevation of the lowered water level corresponds to about 38,100 acre-feet (AF) of storage, which is approximately 60 percent less than the pre-DSOD restricted total water storage volume.

Following approximately six years of engineering studies, the SFPUC proposes to construct a new dam to replace the existing Calaveras Dam. The replacement dam, to be located immediately downstream at the foot of the existing dam, would respond to DSOD requirements to improve seismic safety. Implementation of the CDRP would allow the reservoir to be filled to its former volume of about 96,850 AF. This would restore the previously existing yield and reliability of the SFPUC local system and provide water supply during droughts.

Under Chapter 3 of the San Francisco Administrative Code, the San Francisco Planning Department's Major Environmental Analysis Division (MEA) is responsible for implementing environmental review for all City and County of San Francisco projects. This Draft EIR has been prepared by MEA pursuant to the requirements of the California Environmental Quality Act (CEQA) in California Public Resources Code Sections 21000 *et seq.*, and the State CEQA Guidelines in California Code of Regulations Title 14, Sections 15000 *et seq.* On October 24, 2005, MEA prepared and distributed a Notice of Preparation to public agencies, groups, and interested individuals, pursuant to the requirements of CEQA. This project-level EIR is intended to provide the public and decision-making agencies with information about physical environmental impacts that could result from construction and operation of the proposed CDRP. It describes potentially significant impacts, identifies mitigation measures that would avoid significant impacts or reduce them to less-than-significant levels, identifies significant impacts that cannot be reduced to less-than-significant levels even with the implementation of feasible mitigation measures (i.e., significant and unavoidable impacts), and evaluates feasible alternatives to the proposed project.

1.2 OVERVIEW OF THE SFPUC REGIONAL WATER SYSTEM

Calaveras Dam and Reservoir are part of the SFPUC's regional water system and the information in this section about the SFPUC regional water system provides background and context for this project.

The City and County of San Francisco, through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves retail and wholesale

customers in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The regional water system consists of water collection, storage, conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers. The existing regional system includes over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, 5 pump stations, and 2 water treatment plants. The SFPUC currently delivers an annual average of about 265 million gallons per day (mgd) of water to its customers. The source of the water supply is a combination of local supplies from streamflow and runoff in the Alameda Creek watershed and in the San Mateo and Pilarcitos Creeks watersheds (referred to together as the Peninsula watersheds), augmented with imported supplies from the Tuolumne River watershed. Local watersheds provide about 15 percent of total supplies and the Tuolumne River provides the remaining 85 percent.

The SFPUC delivers about one-third of its water supplies directly to retail customers, primarily in San Francisco, and about two-thirds of its water supplies to wholesale customers by contractual agreement. The wholesale customers are largely represented by the Bay Area Water Supply and Conservation Agency (BAWSCA), which consists of 27 total customers. Some of these wholesale customers have other sources of water in addition to what they receive from the SFPUC regional system, while others rely completely on the SFPUC for supply.

1.2.1 SFPUC WATER SYSTEM IMPROVEMENT PROGRAM

On October 30, 2008, the SFPUC adopted a regional Water System Improvement Program (known as the “Phased WSIP Variant”) (SFPUC 2008). The Water System Improvement Program (WSIP) will improve the regional system with respect to water quality, seismic response, and water delivery based on a planning horizon through the year 2030. The WSIP will improve the regional system with respect to water supply to meet water delivery needs in the service area through the year 2018. The program area spans seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco. The CDRP is one of the SFPUC’s WSIP projects.

The WSIP includes a water supply strategy and modifications to system operations, and construction of a series of facility improvement projects. The overall goals of the WSIP are to maintain high-quality water; reduce vulnerability to earthquakes; increase delivery reliability and improve the ability to maintain the system; meet customer water supply needs; enhance sustainability in all system activities; and achieve a cost-effective, fully operational system (see Table 2.1 in Chapter 2, Introduction and Background, which lists the WSIP’s goals and objectives). To further these program goals, the WSIP also includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply (see SFPUC Resolution 08-0200).

To address the potential environmental impacts of the WSIP, the San Francisco Planning Department prepared a Program EIR (PEIR) on the proposed WSIP, which was certified by the San Francisco Planning Commission on October 30, 2008 (San Francisco Planning Commission Motion No. 17734). At a project level of detail, the PEIR evaluated the environmental impacts of the WSIP's water supply strategy and, at a program level of detail, it evaluated the environmental impacts of the WSIP's facility improvement projects. The PEIR is available for public review at the San Francisco Planning Department, 1650 Mission Street, San Francisco, CA 94103, and is on the Planning Department's website at <http://www.sfgov.org/planning/mea>. The State Clearinghouse Number for the PEIR is 2005092026. This project-level EIR for the CDRP tiers from the PEIR and also incorporates by reference the relevant analyses of the PEIR with respect to the WSIP's impacts and mitigation measures, as applicable to this project. CEQA permits tiering from a program EIR in order to allow agencies to broadly consider the environmental effects of a series of actions and/or policies and then to provide more detailed examination of project-specific impacts in project-level EIRs. The CDRP was defined as part of the WSIP in the PEIR and was analyzed in the PEIR as part of the WSIP. This EIR provides more detailed information about the proposed project, its impacts, and project-specific mitigation measures. This EIR summarizes and incorporates by reference the PEIR's analysis of the impacts associated with the WSIP's water supply strategy, including the PEIR analysis and conclusions regarding impacts on the SFPUC's watersheds and growth inducement impacts. Also, to the extent affected by the CDRP, this EIR re-evaluates impacts analyzed as part of the PEIR water supply and system operations analysis in the Alameda Creek watershed. With respect to other watersheds, this project's contribution to impacts as part of the WSIP was fully analyzed and considered in sufficient detail in the PEIR's analysis of water supply and growth inducement impacts. The following sections summarize the WSIP and system operation strategy, and also summarize the WSIP's impacts and mitigation measures, as identified in the PEIR.

1.2.1.1 Program Description

The WSIP involves improvements to the regional system with respect to water quality, seismic response, and water delivery based on a planning horizon through the year 2030. The WSIP also includes phased implementation of a water supply strategy to meet projected water demand through 2018. It also includes full implementation of all proposed WSIP facility improvement projects to ensure that the public health, seismic safety and delivery reliability goals are achieved as soon as possible.¹ Under the WSIP, the SFPUC established an interim mid-term planning horizon for its water supply strategy – 2018. Thus, the SFPUC made a decision about providing water supply to its customers through 2018 only, and will consider a decision regarding long-term

¹ The size and design of the WSIP facility improvement projects are driven by the SFPUC's system performance objectives and would not change as a result of the water supply decision included as part of the WSIP (see SFPUC Resolution No. 08-0200).

water supply after 2018 and through 2030 after it undertakes further water supply planning and demand analysis.

The WSIP includes the following key program elements:

- Full implementation of all of the 17 proposed WSIP facility improvement projects described in the PEIR.
- Water supply delivery to regional water system customers through 2018 only of 265 mgd average annual target delivery originating from the Tuolumne, Alameda and Peninsula watersheds. This includes 184 mgd for the wholesale customers (including 9 mgd for the cities of San Jose and Santa Clara), and 81 mgd for the retail customers.
- Development of 20 mgd of conservation, recycled water, and groundwater projects within the SFPUC service area (10 mgd in the retail service area and 10 mgd wholesale service area).
- Dry year transfer from Modesto and/or Turlock Irrigation Districts of about 2 mgd coupled with the Westside Groundwater Basin conjunctive-use project to meet the drought year goal of limiting rationing to no more than 20 percent on a systemwide basis.
- Re-evaluation of 2030 demand projections, potential regional water system purchase requests, and water supply options by 2018 and a separate SFPUC decision in 2018 regarding regional water system water deliveries after 2018.
- Financial incentives to limit water sales to an annual average of 265 mgd from the watersheds.

Under the WSIP, the SFPUC will deliver to customers up to 265 mgd from the SFPUC watersheds on an average annual basis. While average annual deliveries from the SFPUC watersheds would be limited to 265 mgd, such that there would be no increase in diversions from the Tuolumne River to serve additional demand, there would be a small increase in average annual Tuolumne River diversions of about 2 mgd over existing conditions in order to meet delivery and drought reliability goals through 2018.

The SFPUC must maintain water deliveries to all its customers for the protection of public health and safety. Therefore, under the WSIP, the SFPUC will work with its customers to develop financial incentives to limit water sales to an average annual amount of 265 mgd from the watersheds through 2018. With the projected 20 mgd of conservation, recycled water, and groundwater projects, the system would meet average daily demand of 285 mgd in 2018.

As part of adoption of the WSIP, the SFPUC will implement the mitigation measures identified for the WSIP in the PEIR, including measures addressing impacts that may result from increases in deliveries from the SFPUC watersheds over the total average annual of 265 mgd in the event that conservation, recycled water, and groundwater projects are not completed prior to the increase in customers' demand (SFPUC Resolution No. 08-0200).

1.2.1.2 WSIP System Operation Strategy

The WSIP also provides a future operating strategy for the regional water system, which addresses the condition of the physical facilities and infrastructure while accounting for factors that affect the system including fluctuating customer demand, meteorological and hydrological conditions, facility and infrastructure capacity and maintenance requirements, and institutional parameters. The operating strategy addresses four components of system operation: water supply and storage, water quality, water delivery, and asset management.

Day-to-day operation of the regional water system under the WSIP would be similar to existing operations, but would provide for additional facility maintenance activities and improved emergency preparedness. This would allow the SFPUC to meet its WSIP objectives and provide for increased system reliability and additional flexibility for scheduling repairs and maintenance. The proposed operations strategy would also include a multistage drought response program. Under the WSIP, regional water system operations would continue to comply with all applicable institutional and planning requirements including complying with all water quality, environmental, and public safety regulations; maximizing the use of water from local watersheds; assigning a higher priority to water delivery over hydropower generation; and meeting all downstream flow requirements.

1.2.1.3 Summary of Water Supply/Operations Impacts

The PEIR analyzed potential water supply and system operations impacts within the following geographic regions: the Tuolumne River, Alameda Creek, Peninsula watersheds, and North Westside Basin and South Westside Basin groundwater resources systems. The PEIR also identified the cumulative effects of implementing the WSIP and system operations in combination with other past, present, and reasonably foreseeable future projects within each of these watersheds. It also discussed the potential effects of climate change and global warming on the regional water system. These analyses in the PEIR are hereby incorporated by reference in this EIR and are summarized in the appropriate sections of this EIR.

The WSIP would result in changes in reservoir levels and associated changes in downstream flows in rivers and creeks in the three affected watersheds, potentially resulting in adverse effects on groundwater, water quality, fisheries, and terrestrial biological resources. In the event that watershed deliveries to customers from these sources exceed 265 mgd (average annual), further streamflow changes in the Tuolumne River watershed could affect fisheries and terrestrial biological resources. In the Alameda Creek and Peninsula watersheds, the WSIP, which includes restoring the historical storage capacities of Calaveras and Lower Crystal Springs Reservoirs, could affect reservoir levels, downstream flows, fisheries, and terrestrial biological resources. In addition, the WSIP will develop groundwater supplies in the North Westside Groundwater Basin as well as a conjunctive-use program in the South Westside Groundwater Basin.

The WSIP impacts identified in the PEIR that are potentially significant but mitigable, potentially significant and unavoidable, and significant and unavoidable are listed below. As set forth in the PEIR, the San Francisco Planning Department determined the environmental impacts of water supply and system operations on all resources not listed below would be less than significant and no mitigation measures for these impacts would be required. (In this EIR, see Subsection 4.1.4, WSIP Water Supply and Operations Strategy Impacts and Mitigation, in Chapter 4, Environmental Setting and Impacts, for further discussion of the impact analysis on the WSIP's water supply strategy; see PEIR Chapter 6 for a list of the mitigation measures associated with these impacts. See also PEIR Chapter 16 for a short list of corrections to these mitigation measures.)

Potentially Significant but Mitigable WSIP Water Supply Impacts

- Fisheries Resources: Tuolumne River (only when average annual deliveries from all watersheds exceed 265 mgd); Alameda Creek; Pilarcitos Creek; Pilarcitos Reservoir
- Terrestrial Biological Resources: Tuolumne River (below La Grange Dam - only when average annual deliveries exceed 265 mgd; and impacts on alluvial features that support meadow and riparian habitat from O'Shaughnessy Dam to Don Pedro Reservoir); Calaveras Reservoir; Alameda Creek; Calaveras Creek; Upper and Lower Crystal Springs Reservoir
- Water Quality: Pilarcitos Reservoir; Pilarcitos Creek
- Groundwater: Pumping overdraft; change in water levels in Lake Merced and other surface water features; seawater intrusion due to decreased groundwater levels; contamination of drinking water

Potentially Significant and Unavoidable WSIP Water Supply Impacts

- Fisheries: Upper and Lower Crystal Springs Reservoir
- Growth inducement: SFPUC Service Area

Significant and Unavoidable WSIP Water Supply Impacts

Streamflow: Alameda Creek below Alameda Creek Diversion Dam (ACDD) (Note: based on changes to the proposed operations of Calaveras Reservoir and the ACDD and subsequent project-specific analysis of the water supply and system operations impacts on Alameda Creek hydrology, the significance determination for this impact has been revised to less than significant at the project level [see Section 4.6, Hydrology, of this EIR].)

1.2.1.4 Alternatives to the WSIP

The PEIR evaluated seven alternatives to the WSIP. These alternatives were selected for analysis because of their apparent ability to meet most of the WSIP's goals, their ability to reduce one or more of the significant impacts associated with program implementation, their potential feasibility, and their collective ability to provide a reasonable range of alternatives to foster

informed decision-making and public participation. Analysis of the No Program Alternative is also included as required by CEQA. The seven WSIP alternatives are summarized in Section 7.2 in the Alternatives chapter in this EIR; PEIR Chapters 9 and 14 present a more detailed summary of these alternatives and are incorporated into this EIR by this reference.

1.3 PROJECT OBJECTIVES AND BACKGROUND

1.3.1 PROJECT OBJECTIVES

Calaveras Dam and Reservoir are important components of the SFPUC regional water system. Calaveras Dam allows for storage of local watershed runoff in the Alameda Creek watershed. Calaveras Reservoir provides storage only for the water from its local watersheds. Calaveras Reservoir is the largest SFPUC San Francisco Bay Area (local) reservoir, providing about 40 percent of the SFPUC's local water storage and 66 percent of local water yield. The overall purpose of the proposed project is to replace the existing dam with a new dam to accommodate a public water supply reservoir and meet current seismic safety design requirements. When the proposed replacement dam is completed, DSOD restrictions, described above, would be lifted and the original reservoir pool could be restored. For purposes of this EIR, the existing interim lowered water level is the baseline (existing condition) for impact assessment.

The objectives of the proposed project are as follows:

Primary Objectives

- Re-establish water delivery reliability;
- Restore water supply and the capacity of the reservoir to its pre-2001 restriction level of 96,850 acre-feet (AF) using water from the Alameda Creek watershed, thereby restoring 7 million gallons per day (mgd) of water supply during the 8.5-year design drought (the SFPUC's drought planning scenario);
- Improve seismic reliability through construction of a replacement dam designed to safely retain 96,850 AF of water and withstand the maximum credible earthquake (7.25 moment magnitude) on the Calaveras Fault; and
- Construct a new dam with a robust design (wide centrally located clay core, wide filters, and internal drainage) that could accommodate potential enlargement by future generations.

Secondary Objectives

- Continue reservoir and outlet works operation, to the extent possible, during construction; and
- Maintain high water quality, re-creating a deeper pool that would keep water temperatures cooler to limit algal growth in the reservoir.

1.3.2 EXISTING DAM AND RESERVOIR

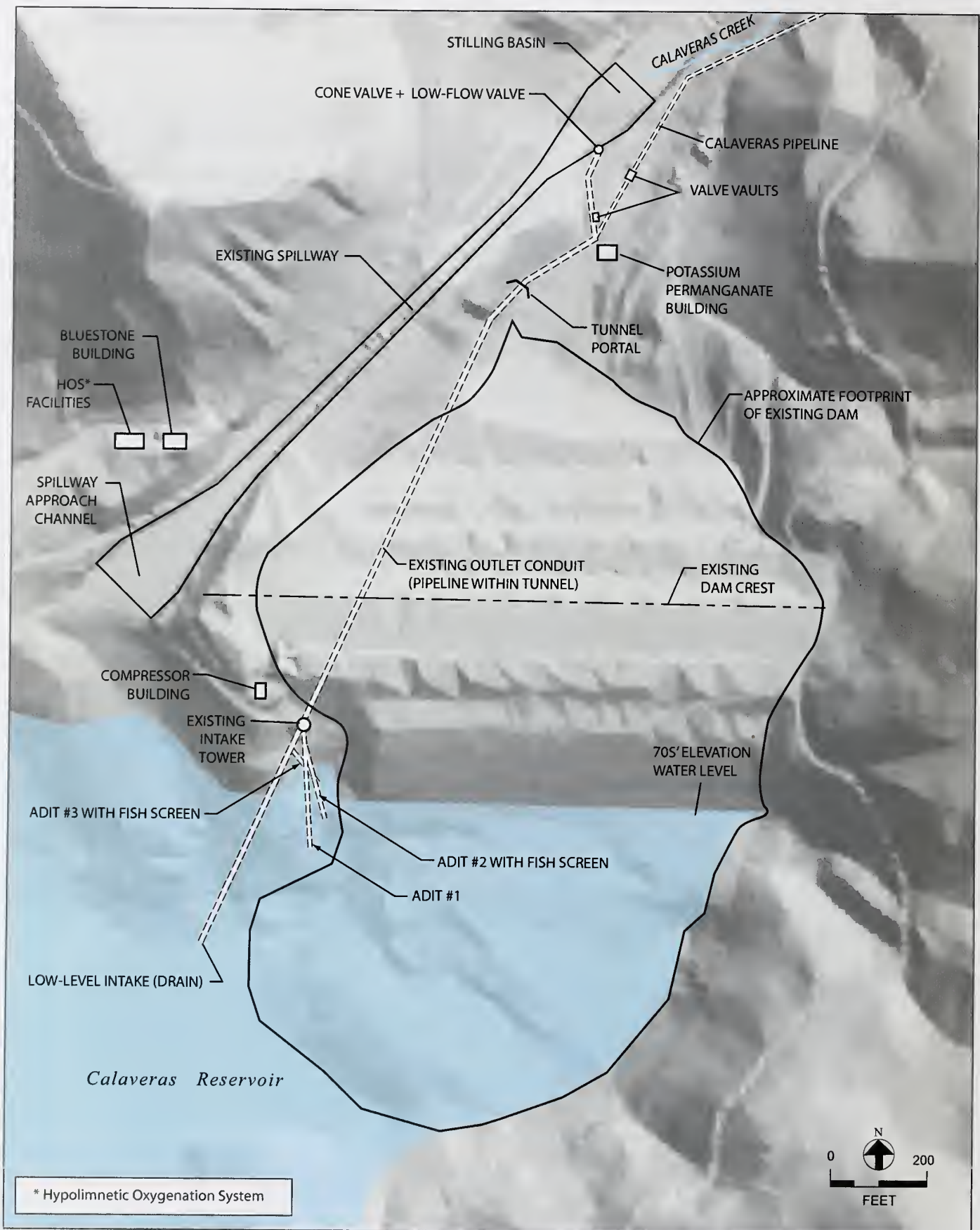
1.3.2.1 Existing Dam

Calaveras Dam is an earth-fill structure on Calaveras Creek that impounds water, creating Calaveras Reservoir. Construction of the existing dam started in 1913. During construction, the upstream side of the dam failed. Reconstruction of the dam was completed in 1925. Large amounts of failed material were left in place within the completed dam. In 1974, portions of the dam were reinforced with a layer of rock up to 30 feet thick. The existing dam is approximately 210 feet high. The crest, at elevation 778.6 feet, is approximately 1,200 feet long. The existing dam and its associated facilities are shown in Figure S.1, Existing Facilities.

Spillway. The existing spillway is located immediately west of the dam on the left abutment. The spillway is an outlet that prevents the reservoir from overtopping the crest of the dam. The spillway consists of an approach channel on the upstream side with an ungated crest at elevation 756.2 feet and, on the downstream side, a chute terminating in a stilling basin. It discharges into Calaveras Creek approximately 800 feet downstream from the crest of the dam.

Outlet Works. The outlet works include an intake tower, vertical shaft, and an outlet tunnel. Their function is to withdraw water from the reservoir and direct it into the Calaveras Pipeline that conveys the water to the Sunol Valley Water Treatment Plant (SVWTP), about 4 miles north of the dam, or to the San Antonio Reservoir, or release it into Calaveras Creek. The intake tower is located in the reservoir. Intake pipes (called adits) at three elevations and a low-level intake (drain) line run from the reservoir to the intake shaft. For water quality reasons and to minimize fish entrainment, water intake has typically occurred through the upper adits which have fish screens.

Control Valves. The intake valves for the outlet works are located in the intake shaft. The lowest intake valve is manually controlled. Controls for the other intake valves are electronic. Additional control valves are located at the downstream end of the outlet tunnel. The 72-inch-diameter cone valve can release up to 870 cubic feet per second (cfs) to provide rapid lowering of the reservoir. In 2006, the SFPUC installed a temporary 12-inch low-flow release valve for studies of fisheries and other aquatic resources. The low-flow valve allows flow releases from the reservoir that better approach the natural hydrology of Calaveras Creek downstream of Calaveras Dam and Alameda Creek downstream of the confluence with Calaveras Creek.



SOURCE: URS; EDAW&Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE S.1: EXISTING FACILITIES

1.3.2.2 Existing Reservoir

Calaveras Reservoir collects the flows from the Calaveras Creek and Arroyo Hondo watersheds. It also collects water from the upper Alameda Creek watershed by means of the ACDD and a 1.8-mile-long tunnel. Prior to 2002, in a typical year, upper Alameda Creek contributed most of its flow to Calaveras Reservoir. The diversion dam has operated on a limited basis since the 2001 DSOD restriction on reservoir elevation.

The storage capacity of the Calaveras Reservoir at nominal pool elevation 756 feet was approximately 96,850 AF. In 2001, DSOD limited the pool elevation of the reservoir to 705 feet. Water levels may briefly rise above elevation 705 feet following large storms (like those in spring 2006), but the SFPUC must withdraw and release water as quickly as possible to return the pool to elevation 705 feet. At this level, Calaveras Reservoir stores approximately 38,100 AF of water.

In accordance with a 1991 Memorandum of Understanding (MOU) with the California Department of Fish and Game (CDFG), the SFPUC maintains a minimum pool elevation of 690 feet (approximately 30,000 AF) to minimize the potential for entrainment of fish into the low-level intake, which has no fish screen. During a drought or water supply emergency, the reservoir is allowed to be drawn down further.

The surface area of Calaveras Reservoir at elevation 756 feet was approximately 1,465 acres. At the restricted pool elevation of 705 feet, the surface area of the reservoir is approximately 860 acres. At elevation 756 feet, the reservoir was approximately 3.2 miles long and 1.0 mile wide. At the reduced elevation, the reservoir is approximately 2.2 miles long and 0.8 mile wide. The depth of the reservoir varies seasonally as runoff is received and as withdrawals and releases are made. At the restricted elevation, the depth at the deepest point of the reservoir is approximately 85 feet. At elevation 756 feet, the depth at the deepest point was approximately 135 feet.

Sediment is carried into the reservoir with runoff and deposited in the reservoir, which after 80 years has slightly reduced reservoir storage capacity.

Water Quality. Water quality data collected from 2001 to 2005 indicate that the water in Calaveras Reservoir was of excellent quality and consistently met regulatory standards. However, at the restricted pool elevation, conditions favoring the growth of undesirable algae are enhanced. Increased algal content in the water has caused taste and odor problems. On-site water treatment (described later) has corrected these problems.

The SFPUC protects water quality by restricting public access to the reservoir and to the watershed. The SFPUC has begun installing riparian fencing to protect and improve water quality and aquatic habitat structure and quality.

1.3.2.3 Other Existing Structures

There are several structures that support maintenance and operation of the dam and reservoir: the watershed keeper's residence, the potassium permanganate building, the warehouse/compressor building, the bluestone building, and the hypolimnetic oxygenation system (HOS) facilities. (The HOS improves the dissolved oxygen level in the deeper portions of the reservoir.)

1.3.2.4 Existing Operation

Water in Calaveras Reservoir is withdrawn by the outlet works into the Calaveras Pipeline for water supply, or released to Calaveras Creek to lower the water level in the reservoir.

Water Supply Withdrawal. Water supply withdrawals enter the Calaveras Pipeline and then flow either to the SVWTP or to San Antonio Reservoir for storage. The amount of water that the SFPUC withdraws per year from Calaveras Reservoir for water supply purposes varies substantially, depending on maintenance at the dam and the SVWTP, as well as weather conditions and reservoir water quality. Withdrawals from the reservoir for water supply are greatest from fall through spring.

Spillway and Cone Valve. There have been no spillway releases since December 2001. Releases through the cone valve are made when necessary to lower the reservoir water elevation. Cone valve releases also occur for dam safety compliance tests. Releases through the cone valve vary in duration depending on the reservoir level. Once begun, releases through the cone valve typically continue for several weeks.

Alameda Creek Diversion. The ACDD was constructed in 1931 to increase the reservoir's water supply. The concrete dam is about 30 feet high and 173 feet wide. When the diversion dam and tunnel are in use, flow from upper Alameda Creek is diverted by manually operated gates to Calaveras Reservoir via a tunnel. Up to 650 cfs can be diverted from the creek. Since implementation of the DSOD storage restriction, the length of the diversion period has been substantially reduced in some years. If water is not diverted, it flows over the top of the diversion dam. The ACDD also has a manually operated gate to allow flows to flush sediment to the creek downstream of the dam (a process called sluicing).

Operating Staff. Minimal staff is needed to operate the dam and reservoir. A watershed keeper lives at the reservoir site and provides security and observation. Operation of the valves controlling withdrawals to the SVWTP is performed remotely. Other operations (including all releases and ACDD diversions) are done by a crew dispatched from the SFPUC Sunol Maintenance Yard. Calaveras Dam is checked at least once a day.

Reservoir Limnology. During winter when inflow to the reservoir occurs, the water is mixed and has relatively uniform temperature. In the warm season, cold water remains at the bottom of

the reservoir while the surface water warms, creating a stratified condition. In Calaveras Reservoir, stratification begins in late spring after the rainy season ends and reservoir inflows are reduced, and warmer weather begins. Reservoir stratification typically lasts for approximately 8 months. The reservoir becomes de-stratified again in mid-winter as the reservoir refills. When Calaveras Reservoir is stratified, algae grow rapidly in the warm surface waters. The presence of algae causes taste and odor problems in the water. In the bottom waters, dissolved oxygen is low, which allows metals (iron and manganese, which are naturally present in the sediment) to be dissolved into the reservoir water. The low dissolved oxygen also is deleterious to fish. These water quality conditions have been exacerbated since the reservoir water elevation was lowered.

On-Site Water Treatment. Water withdrawn from Calaveras Reservoir to the SVWTP is pretreated with potassium permanganate to oxidize organic material. The SFPUC also operates the HOS to improve the dissolved oxygen level in the deeper portions of the reservoir to prevent metals from becoming dissolved. The increased oxygen level is also beneficial to fish. Additionally, to control the growth of algae in the reservoir, the SFPUC currently uses sodium percarbonate (an algaecide that releases hydrogen peroxide into the water to kill algae). When treatment through application of sodium percarbonate is ineffective in controlling algae growth, the SFPUC uses copper-based algaecides as a secondary tool, including copper sulfate.

1.4 PROJECT DESCRIPTION

The main elements of the proposed project are as follows:

- Construct a new earth and rockfill dam with a robust design (wide centrally located clay core, wide filter, and internal drainage) that could accommodate potential enlargement by future generations, and modification (regrading) of the existing dam to accommodate the construction and operation of the new replacement dam;
- Remove the existing spillway and construct an ungated spillway with a concrete-lined channel and a new stilling basin;
- Remove the existing intake tower, plug the shaft, and construct a new intake tower and shaft connecting to an existing drain and three water inlet adits;
- Extend the outlet pipe connecting to a relocated, fixed cone valve, and install new low-flow discharge valves for fishery releases;
- Install instrumentation such as piezometers, inclinometers, settlement monuments, seepage weirs, and accelerometers to measure strong ground motions during earthquakes;
- Stabilize the right abutment landslide; and
- Construct a bypass tunnel, with a gate to control bypass flows, through the ACDD.

1.4.1 DESIGN CRITERIA

Calaveras Dam is under the jurisdiction of DSOD. The performance objectives that would be incorporated into the design of the replacement dam are as follows:

- Freeboard and spillway capacity would be designed for an inflow design flood based on the Probable Maximum Precipitation event.
- Outlet releases would have sufficient capacity to meet DSOD emergency reservoir evacuation requirements.
- The dam and related works would remain functional after an earthquake. This requires that the safety of the dam embankment itself not be impaired by 1) extensive cracking, 2) crest settlement that would impair freeboard, and 3) excessive deformation in critical zones such as filters and drains. It also requires that the outlet works and spillway remain intact and operational.

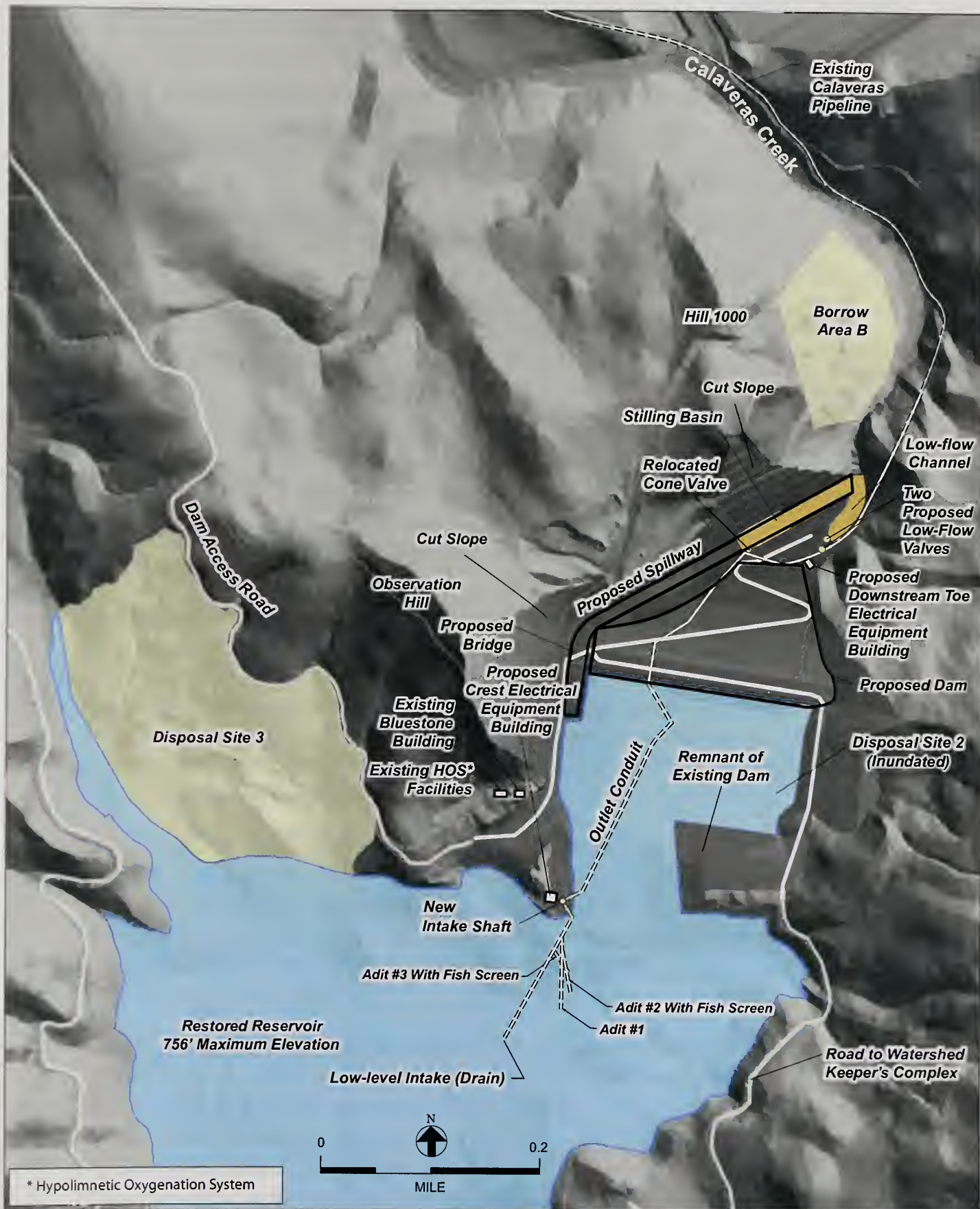
1.4.2 DESIGN AND COMPOSITION OF THE REPLACEMENT DAM

The replacement dam would be located immediately downstream of the existing dam. Figure S.2, Proposed Plan of Dam Area, shows the proposed replacement dam and its associated facilities; Figure S.3, Proposed Dam Cross-Section, presents a cross-section of the proposed dam. The core of the dam would be constructed of clay, and internal filters and drains would be provided. The upstream shell of the dam would be constructed of rockfill. The downstream shell of the dam would be constructed of Temblor Sandstone. The upstream face of the dam would be protected from erosion by a layer of riprap. The downstream face of the dam would be covered with topsoil and hydroseeded. Existing facilities that would be retained would be from the outlet works: the intake adits, the drain pipe, and the portion of the outlet pipe that runs beneath the existing dam.

Table S.1 compares the characteristics of the existing dam to those of the proposed replacement dam.

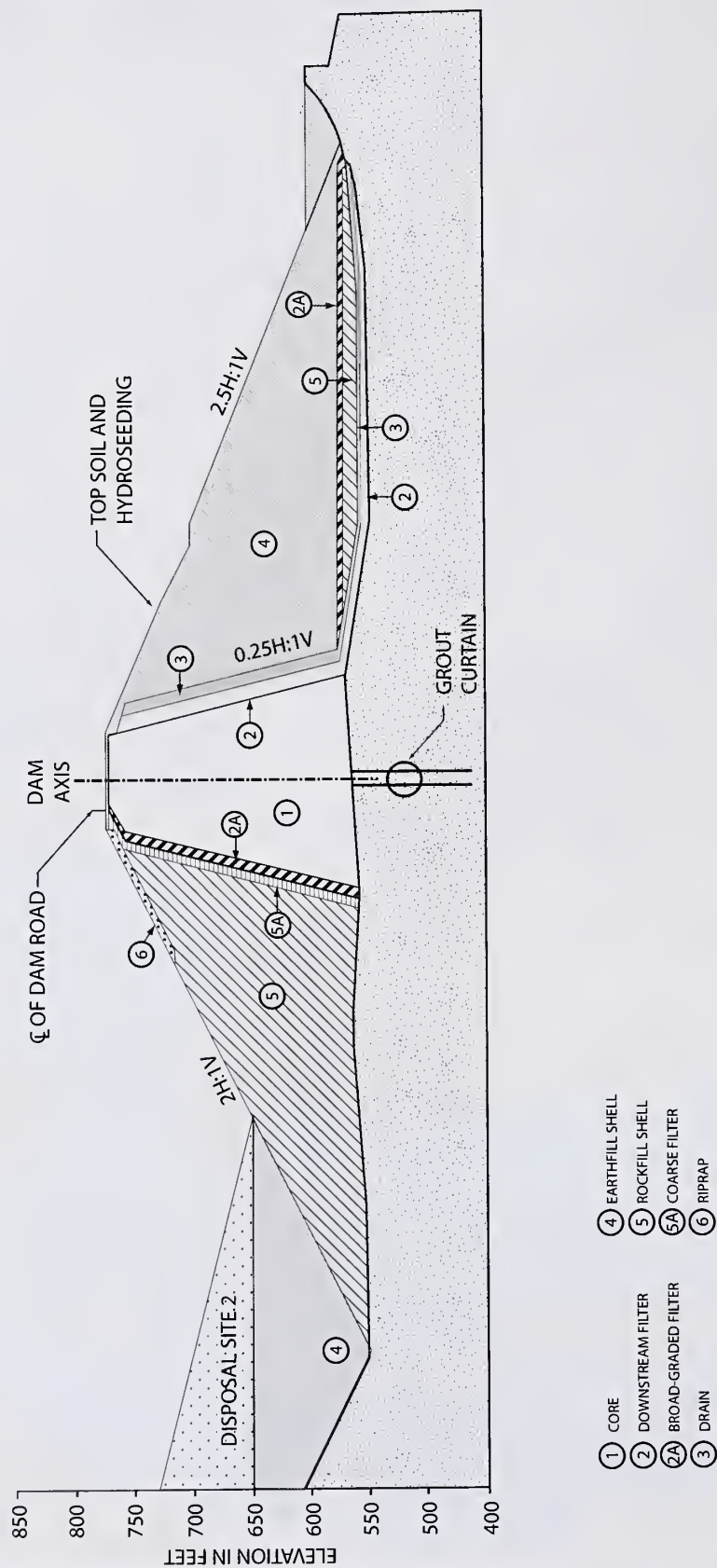
Spillway. The new spillway would be constructed at the western end (left abutment) of the dam and would be larger than the existing spillway. The ungated entrance to the spillway would be a 78-foot-by-307-foot apron at elevation 748. The entrance would lie between two approach walls, as follows:

- The left approach wall would be constructed against the rock wall created by the excavation of the spillway; and
- The right approach wall would extend 62 feet into the reservoir, ending in a 24-foot-diameter circular section.



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE S.2: PROPOSED PLAN OF DAM AREA



SOURCE: URS; ED&A/Turnstone JV

Table S.1: Comparison of the Existing Dam with the Proposed Replacement Dam

Dam Characteristic	Existing Dam	Replacement Dam
Type of Construction	Earthfill, part hydraulic sluiced, clay core	Earth and rockfill with clay core
Volume	3.46 million cubic yards	2.77 million cubic yards
Height - Toe to Dam Crest	210 feet	210 feet
Crest Elevation ¹	778.6 feet	772 feet
Crest Length	1,200 feet	1,210 feet
Freeboard - Spillway Crest to Top of Dam	22.4 feet	15.8 feet
Footprint	18 acres	18 acres
Width at Base	1,510 feet	1,180 feet
Width at Crest	80 feet	80 feet
Minimum Reservoir Level ² (elevation ¹)	690 feet	690 feet
Notes: ¹ Elevation relative to National Geodetic Vertical Datum 1929. ² As identified in the 1991 MOU. The lowest intake is 603 feet (elevation).		

Source: SFPUC 2009

The spillway crest would be a weir at elevation 756 feet. After flowing over the crest, spill flows would be directed first through a 550-foot-long chute at a 3 percent slope that would turn to the right, then through a 550-foot-long steeper (30 percent slope) straight section. The spillway chute downstream of the crest would be a rectangular, concrete-lined channel that would narrow from 80 feet wide at the entrance to 60 feet wide at the top of the 30 percent sloping straight section. The lower part of the spillway would include chute blocks that would break the speed and energy of the flow in the spillway as it discharges into the stilling basin.

Intake Shaft and Adits. A new intake structure would consist of a circular shaft excavated in rock. A concrete tower would extend above ground surface to a height of approximately 30 feet. The three existing adits and the existing drain would be retained. New tunnels would connect the adits and drain to the existing outlet pipeline. The portion of the existing intake tower below grade would be filled with concrete and the portion above grade (including the tower and arched walkway) would be demolished.

Outlet Pipe and Stream Discharge Valves. The existing outlet conduit would be extended approximately 1,100 feet downstream, then would bifurcate at the toe of the replacement dam. One branch would connect to the existing Calaveras Pipeline, while the other branch would connect to the relocated cone valve and discharge to the new spillway stilling basin. Two new low-flow valves would release water to a separate energy dissipater, then into Calaveras Creek. The new low-flow valves would be primarily used for water releases to maintain fisheries and aquatic habitat, as called for under the 1997 MOU.

Supporting Facilities. The HOS and bluestone building would remain in their present locations. The existing warehouse/compressor building would be demolished and replaced with a new electrical equipment building. The potassium permanganate building would be demolished and would not be replaced. A second new electrical equipment building would be constructed on the downstream toe of the replacement dam. The watershed keeper's residence located south of the dam would be vacated during construction.

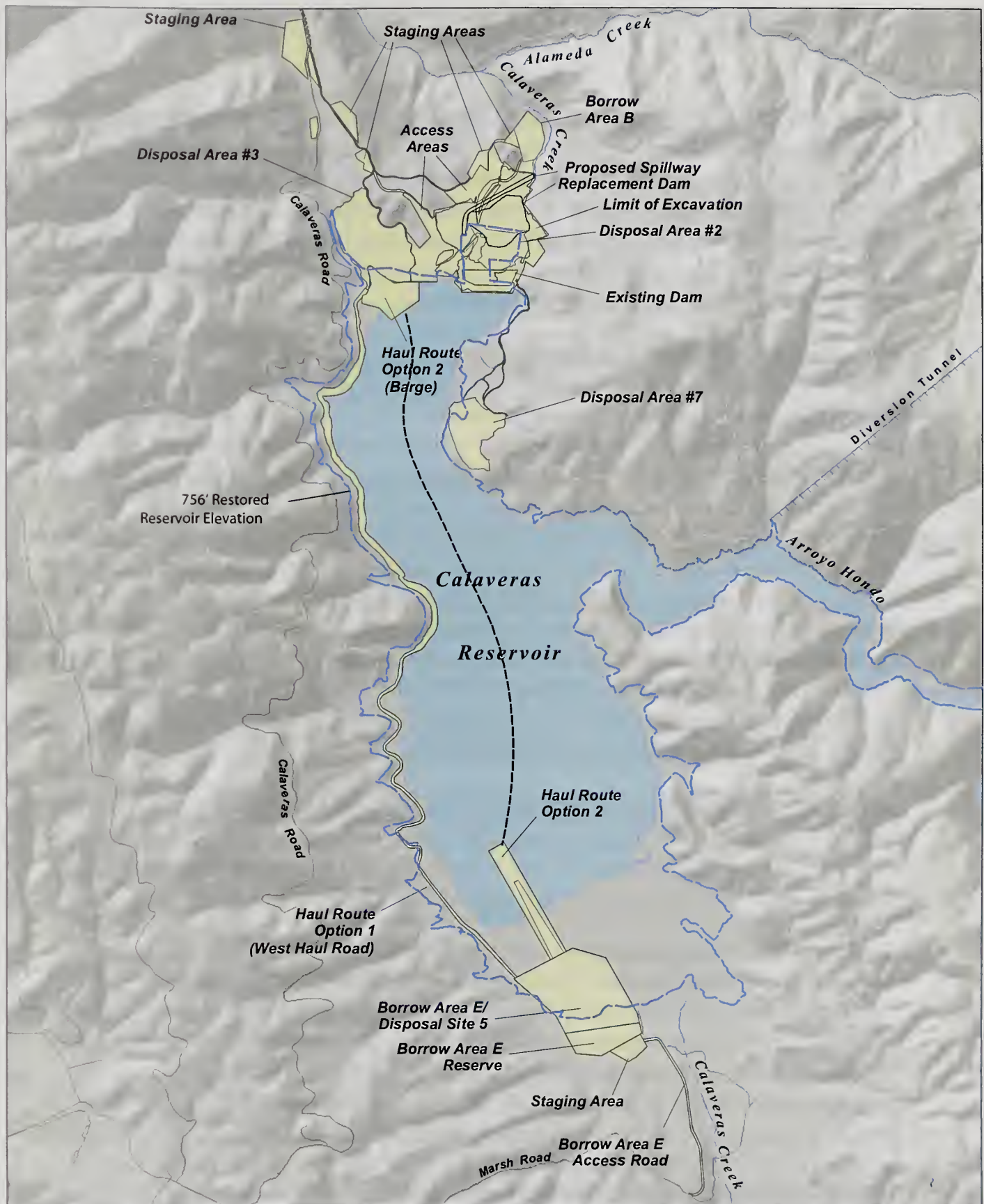
Instrumentation. Instrumentation, such as piezometers, inclinometers, and weirs, would be installed in the dam embankment and foundation, downstream of the dam, and in the abutments. The type, number, and location of instrumentation would be based on the specific engineering parameters that need to be monitored. These include lateral movement of the dam embankment, settlement, seepage flows, pore-water pressure, and seismic response.

Alameda Creek Diversion Dam Bypass Facility. Seismic upgrade of the ACDD and tunnel is not required. The SFPUC would construct a bypass facility to support flows for fish habitat. The ACDD Bypass Facility would consist of a bypass tunnel through the ACDD abutment and a gate to control bypass flows. The ACDD bypass would permit controlled bypass flows from the ACDD; these flows are intended to provide suitable habitat conditions for rainbow trout in Alameda Creek downstream of the ACDD. Operation of the ACDD bypass would be the primary means of providing flow releases for fish, when sufficient flows are present in Alameda Creek.

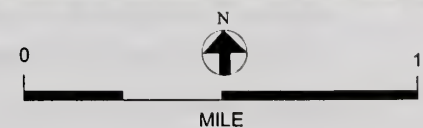
1.4.3 CONSTRUCTION OF THE REPLACEMENT DAM

1.4.3.1 Project Construction

The primary construction activities for the proposed project would be excavation of the dam foundation and spillway; transportation of fill materials from borrow areas on the project site and from off-site sources; transportation of unusable soil and rock to disposal sites on the project site; construction of the dam embankment; forming and placement of concrete for the new intake tower/shaft and spillway; and extension of the outlet works. As shown in Figure S.4, Work Limit Area, the project site would encompass borrow areas (areas of excavation that would provide much of the material for construction of the replacement dam); roads; staging areas (areas used for office trailers, on-site testing laboratory, materials storage, and stockpiles); disposal sites (sites used for the disposal of unsuitable and excess soil and rock); and access areas (open areas used by construction vehicles and equipment to reach the various areas of excavation, staging areas, and disposal sites). The construction contractor would be required to work inside the work limit area, which includes all staging, borrow, disposal, and haul road areas, as well as the dam and related-facility construction sites. The work limit area defines the approximate area of direct ground disturbance and encompasses a total of about 343 acres.



SOURCE: URS



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE S.4: WORK LIMIT AREA

Use of the Existing Dam as the Cofferdam. The existing dam would function as a cofferdam during construction of the replacement dam and would also provide 100-year storm flood protection during construction. At the end of construction, an approach channel would be excavated through the west side of the cofferdam, as shown in Figure S.2. The remaining portion of the cofferdam would be left in place. The excavated material from the cofferdam would be placed in one of the disposal sites. Riprap would be placed on the surfaces between the replacement dam and the cofferdam for erosion protection.

Excavation and Construction of the Foundation and Embankment. The replacement dam would be founded on bedrock. There are two types of bedrock at the project site: Temblor Sandstone in the left abutment and Franciscan Complex in the valley bottom and right abutment. The Franciscan Complex is the weaker rock and, in the east abutment, forms an unstable landslide. Foundation excavations would be up to approximately 100 feet below ground surface in the Temblor Sandstone and up to approximately 80 feet below ground surface in the Franciscan Complex. Deeper excavation in the Temblor Sandstone is required under the core of the dam to extend through a zone of highly pervious, fractured rock that is up to 100 feet thick. Less excavation is required in the Franciscan Complex because it does not have highly pervious fractured rock. Portions of landslides that are located within the footprint of the proposed dam would be removed during foundation excavation, and the east abutment landslide would be stabilized. Groundwater encountered during the excavation of the foundation would be treated as necessary, then discharged to Calaveras Creek. Discharge of seepage would require a National Pollutant Discharge Elimination System (NPDES) permit.

Excavation and Construction of the Spillway. Approximately 1.87 million cubic yards of material would be excavated for the spillway. The northern and southern ends of the spillway excavation area would be graded into a series of benches cut into Observation Hill and Hill 1000, stabilized with shotcrete and bolting, and revegetated where possible.

Sources of Material for Construction. The new Calaveras Dam would require approximately 2.77 million cubic yards of material. Much of the material needed to construct the dam would be obtained from excavation of the new spillway, and from two borrow areas in the vicinity of the reservoir. Borrow Area B would be located in the hills on the west side of Calaveras Creek, downstream of the existing dam and would be used for rockfill; and Borrow Area E would be located at the south end of the reservoir and would be used for clay fill. Sand and gravel for filters and drains would be imported from commercial sources to be determined by the contractor.

Construction Staging Areas. Staging areas would be required for the contractor's and SFPUC's office trailers, an on-site soils testing laboratory, equipment and maintenance yards, and construction materials storage. They would also be used for stockpiling imported filter, drain, and aggregate materials.

Disposal Sites. Disposal sites would be required for unsuitable and excess material generated from the excavations. The disposal volume is currently estimated to be approximately 3.8 million cubic yards. Of this volume, approximately 2.4 million cubic yards are soil and rock from the Franciscan Complex and may contain concentrations of naturally occurring asbestos (NOA). Topsoil would be stripped from the sites and stored before excess rock and soil material is deposited. Excavated materials that could contain NOA would be placed in the disposal sites above the proposed normal maximum reservoir surface elevation to prevent NOA from coming into contact with the reservoir water. If NOA-containing material is present, the disposal site would be covered with approximately 4 feet of Temblor Sandstone. At project completion, the disposal sites would be contoured to blend into the existing topography. Native vegetation would be restored.

Four on-site disposal areas have been selected for the CDRP:

- Disposal Site 2 would be located between the existing dam and the replacement dam. Waste materials would be placed within an area of approximately 16.6 acres; about 13.9 acres of the site would ultimately be submerged.
- Disposal Site 3 would be located to the west of the existing dam beside the drainage that flows into the northwestern corner of the reservoir. The site would be approximately 39 acres in area, 7.3 acres of which would be submerged when the reservoir is refilled. A rockfill dike would be constructed at the reservoir shoreline to prevent erosion.
- Disposal Site 5 would be located in Borrow Area E. This site would be used only if the amount of surplus rock and soil exceeds the capacity of Disposal Sites 2, 3, and 7. Disposal Site 5 would be about 60 acres in size. Ultimately, most of this site would be under water.
- Disposal Site 7 would be located on a terrace on the east side of the reservoir. This site would have an area of approximately 17 acres, 0.4 acre of which would be submerged when the reservoir level is restored. A rockfill dike would be constructed at the water's edge to prevent erosion.

Access and Roads. Calaveras Road north of the dam, i.e., between Interstate 680 and the dam access road, would be used as the major hauling route for imported materials for dam construction. For traffic safety reasons, the SFPUC would request permission from Alameda County to close the section of Calaveras Road between a point immediately south of the intersection with Geary Road (south of the SVWTP) and a point near the Santa Clara County line (south of the dam access road) to the public, Monday through Friday, except for emergency vehicles, for hauling of the imported materials for the dam during two periods. The road would be closed for approximately 2 months in summer 2011, then reopened. The second closure period would last for approximately 18 months beginning in winter 2012. In addition, the SFPUC would request permission from Santa Clara County to close the portion of the road between the Alameda County line and Felter Road (near the south end of the reservoir) during the same two periods; the purpose of this additional measure would be to prevent private vehicles that may enter Calaveras Road from the south from needing to turn around at the dead end at the Alameda County line. The SFPUC may also need to request permission to close these sections of

Calaveras Road in both Alameda and Santa Clara Counties at other times, possibly including weekend days, when air quality monitoring indicates unacceptable levels of dust.

The section of Calaveras Road north of Geary Road would remain open during construction and would be used by both private and construction vehicles. No improvements to Calaveras Road are expected to be needed to facilitate project construction. At the completion of construction, Calaveras Road between I-680 and the dam access road would be repaired as needed to restore the road to its pre-construction condition.

The existing dam access road would be extended and would require improvements for construction traffic. The exact location and description of the proposed improvements would be determined by the construction contractor.

New roads would be created to access the construction area. Most haul roads would be between 15 and 20 feet wide, and would be gravel-surfaced or sprinkled with water for dust control. Haul roads that would be used for two-way traffic would be up to 40 feet wide. The contractor would determine the optimum location and alignment of the haul roads. One road would be located on the northeast side of the reservoir using an existing road alignment between the dam and Disposal Site 7. An access road would be constructed from Marsh Road to Staging Area 11 on the south side of Borrow Area E.

The longest new haul route, known as the west haul road, would access Borrow Area E, Disposal Site 5, and Staging Area 11 at the southern end of the reservoir. This temporary haul road would be constructed on the western shore of the reservoir. Based on considerations of cost and schedule, the west haul road is the most likely route to be implemented by the construction contractor. As an alternative to the west haul road, materials would be transported in barges across the reservoir. Barging across the reservoir would require construction of mooring and loading facilities, and is considered less efficient than use of the west haul road. Barging may be used to avoid potential disturbance to nesting bald eagles near the proposed location of the west haul road.

Roads remaining at the end of construction would include the improved dam access road, a new dam crest road, an access road to the downstream toe of the replacement dam, the Borrow Area E access road, and improved portions of previously existing unimproved roads. Nearly all of the west haul road would be submerged when the reservoir is refilled. If the barging alternative is used, all barge facilities would be removed following construction.

Demolition and Construction of Support Buildings. The maintenance warehouse/compressor building and the potassium permanganate building would be demolished; the bluestone building and HOS facility would be unaffected. Two new electrical equipment buildings would be

constructed: one near the location of the demolished warehouse/compressor building, and a second at the toe of the replacement dam.

Blasting. Blasting would be required for excavation of the foundation and spillway and in Borrow Area B to obtain rock materials for the replacement dam. Blasting could be expected to occur as frequently as each day and would occur throughout the construction period. Blasting would take place during daylight hours, Monday through Friday.

Construction of the Alameda Creek Diversion Dam Bypass Facility. A bypass tunnel would be drilled horizontally through the ACDD. The bypass tunnel would be steel-lined to protect against erosion. It would be located behind the existing trash rack at the ACDD, adjacent to the existing sluice tunnel. A gate would be installed on the upstream end of the tunnel to control flows.

A staging area would be created adjacent to the ACDD, and a temporary work containment area would be located on the downstream side of the ACDD. Equipment and materials would be moved between the staging area and the work area by either using a truck-mounted crane or constructing a temporary ramp. Construction of the ACDD Bypass Facility is expected to take approximately 2 to 3 weeks during the dry season.

1.4.3.2 Construction Schedule

The estimated duration of construction would be approximately 4 years. Construction activity would generally consist of two 10-hour shifts per day, 6 days per week throughout the year. The major earth-moving activities would follow this schedule, except blasting, which would be restricted to daylight hours Monday through Friday. Hauling of bulk materials from off-site quarries may occur during weekdays from 7 a.m. to 5 p.m., or may occur at night. If at night, hauling would likely occur between 5 p.m. and 7 a.m. Monday through Friday. Importing off-site materials (sand and gravel) would occur during two periods: approximately 2 months in summer 2011 and approximately 18 months beginning in winter 2012. Occasional deliveries of equipment may also occur on Saturdays; the road might be closed for less than 10 minutes at a time in either direction to accommodate such deliveries.

1.4.3.3 Operation of the Reservoir during Construction

During construction of the replacement dam, the reservoir would continue to operate using the natural inflow whenever possible and releasing water as necessary to Calaveras Creek to maintain the restricted reservoir elevation. There would be two consecutive shutdowns of the outlet works (approximately mid-April to mid-November in either 2011 and 2012 or 2012 and 2013) during excavation of the dam foundation and to connect the new intake shaft to the outlet conduit. The existing dam would be maintained in a condition such that it could safely retain an inflow

equivalent to the 100-year storm event until the replacement dam is completed. During construction, diversions from Alameda Creek would be limited to avoid excess storage and potential inundation of the haul road to Borrow Area E.

1.4.4 PROJECT OPERATION

Refilling of the reservoir would begin after the proposed project construction is complete. The reservoir would be refilled by natural runoff from the watershed drainage area above Calaveras Reservoir and from upper Alameda Creek diversions at the ACDD. Refilling of the reservoir to its planned storage volume could take from 1 to several years depending on rainfall.

1.4.4.1 Changes in Reservoir Operations

On average, the reservoir would be kept fuller for longer periods than under pre-DSOD restriction conditions. The ACDD would be operated in a manner similar to pre-DSOD restriction conditions. There would be a slight decrease in annual average diversions from Alameda Creek compared to diversions under current DSOD-restricted operations. Additional releases from Calaveras Reservoir would occur pursuant to the 1997 MOU. An important difference in operations from both existing and pre-DSOD restriction conditions is that 1997 MOU releases for fish habitat would be made at the proposed ACDD bypass tunnel whenever flow is available in upper Alameda Creek.

Staff needed for operation and maintenance of the dam and reservoir would be the same as at present, i.e., a resident watershed keeper and daily visits by a crew dispatched from the SVWTP.

1.4.4.2 Fishery Releases

The SFPUC is required by the 1997 MOU with the CDFG to release up to 6,300 AF per year of water for enhancement of fisheries and the other natural resources of the creeks. Because of the DSOD restrictions on the reservoir, the MOU flow requirements could not be met and those releases have not occurred. Proposed operation of the reservoir would include the MOU releases. Operation of the ACDD bypass tunnel would be the primary means of providing the rainy season releases identified in the 1997 MOU; however, releases from Calaveras Dam still would be required to meet flow and temperature requirements, particularly in summer when upper Alameda Creek typically has no flow and Calaveras Reservoir has a supply of cold water. Releases from Calaveras Reservoir would be made using the new low-flow valves that would be installed at the dam for this purpose. Releases at the ACDD would occur through the proposed bypass tunnel. The resulting flow regime would be consistent with that prescribed in the 1997 MOU. When flows at the confluence of Alameda and Calaveras Creeks exceed the minimum flow requirements, up to 650 cfs would be diverted from Alameda Creek through the diversion tunnel into Calaveras Reservoir. Fishery releases would begin once the dam is declared operational.

Under the 1997 MOU, there would be three primary flow regimes. The flow rate would be low during the fall, increase beginning in November each year, and remain high through the winter. In spring, the flow rate would diminish and would continue at the same level until decreasing again at the end of the following October, to coincide with the seasonal fishery habitat requirements.

Based on a 1991 MOU with the CDFG, the SFPUC maintains a minimum cold-water pool in the reservoir. Release of this cold water during the summer months is necessary for the survival of trout in Calaveras and Alameda Creeks. Accordingly, the 1997 MOU requires that the SFPUC use its best efforts to maintain a minimum storage of 30,000 AF in the reservoir from July through late October and to provide cold water releases to Calaveras and Alameda Creeks. The point of compliance for the 1997 MOU is the confluence of Calaveras Creek and Alameda Creek.

In addition to the 1997 MOU flow releases, which are intended to support the resident rainbow trout population present in Alameda Creek downstream of the ACDD, the SFPUC also proposes to implement flow release schedules to support anadromous steelhead. At present, passage barriers, including a grade control structure at the point where the Bay Area Rapid Transit rails cross the creek (BART weir), prevent steelhead from migrating to historic spawning grounds in the upper reaches of Alameda Creek and its tributaries. However, the SFPUC and several other public agencies and private and non-profit organizations are undertaking efforts to restore the historic steelhead run in Alameda Creek. As part of that effort, the SFPUC proposes to implement flow release schedules when steelhead have regained access to the Alameda Creek watershed upstream of the BART weir as determined by the National Marine Fisheries Service (NMFS).

1.4.5 DISCRETIONARY APPROVALS AND AGENCIES INVOLVED

1.4.5.1 California Environmental Quality Act

This Draft EIR will undergo a 45-day public review period, including one public hearing in the East Bay on November 10, 2009 and one in San Francisco on November 12, 2009 to obtain comments from the public and agencies on the Draft EIR. The public review period is from October 6, 2009 to November 20, 2009. Following the public review period, responses to written and oral comments received from the public and agencies will be prepared, and revisions to the Draft EIR text will be identified, if appropriate, based on these responses. The Comments and Responses document (included in the Final EIR) will be distributed to all commenters and to individuals providing a written request for the document. The San Francisco Planning Commission will consider certification of the Final EIR, comprised of the Draft EIR, revisions to the Draft EIR text, and the Comments and Responses document. Certification by the Planning Commission can be appealed to the San Francisco Board of Supervisors. Once certified, the EIR

will serve as one source of information to assist the SFPUC in determining whether to approve or modify the proposed project.

1.4.5.2 National Environmental Policy Act

Implementation of the project would require an Individual Permit under Section 404 of the Clean Water Act (CWA) from the San Francisco District, U.S. Army Corps of Engineers (USACE). The USACE will assess the environmental impacts of the proposed action in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA), and the USACE Regulations.

1.4.5.3 Agency Approvals

The project would require the following approvals and permits from various agencies:

- CDFG
 - Streambed Alteration Agreement
 - A 2080/1 Agreement
- San Francisco Bay Area Regional Water Quality Control Board (RWQCB)
 - Water Quality Certification (also known as a Section 401 certification)
 - Waste Discharge Requirement (WDR) under the California Porter-Cologne Water Quality Control Act
 - NPDES Permits
- USACE Individual Permit including, as applicable:
 - compliance with Section 106 of the National Historic Preservation Act
 - NMFS consultation regarding impacts on Endangered Species Act (ESA)-listed endangered species
 - U.S. Fish and Wildlife Service (USFWS) consultation regarding impacts on ESA-listed endangered species
- Caltrans
 - Transportation Permit
- California Department of Water Resources, Division of Safety of Dams
 - Approval of plans and specifications
 - Notice of completion and statement of actual construction cost
 - Construction approval
- Bay Area Air Quality Management District (BAAQMD)
 - “Authority to Construct” permit
- California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA)

- Permit for construction and tunneling
- Alameda County Sheriff
 - Permit to receive, store, transport, and use explosives
- Alameda and Santa Clara Counties
 - Encroachment permits into county right-of-way, including temporary road closures

1.5 SUMMARY OF PROJECT ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Potential environmental impacts from the proposed project would result generally from three primary aspects of the project: construction activity; restoration of the reservoir water level to pre-DSOD restriction levels; and future reservoir operations, in particular as they affect flows within Alameda Creek downstream of the ACDD, and Calaveras Creek below Calaveras Dam.

1.5.1 CONSTRUCTION ACTIVITY

Construction of the proposed dam and partial demolition of the existing dam would require excavation, blasting, transportation, placement, grading, reconfiguration and disposal of large amounts of soil, rock, gravel and sand. Construction of a new spillway below the dam, and of new outlet works and control valves within the dam and reservoir would also be required. Approximately 2.75 million cubic yards of soil and rock would be excavated from borrow sites in close proximity to the existing dam. Approximately 3.8 million cubic yards of excavation and demolition material would be disposed at disposal sites in the project area. Sand and gravel required for construction would be imported from off-site areas. The construction period is estimated to be 4 years and would require use of a substantial amount of construction equipment, trucks, vehicles and workers, as well as a possible barging operation. Barging material across the reservoir is being considered as a partial alternative to hauling material in trucks throughout the project site. Many of the construction-related impacts summarized below would be short term, occurring throughout or within the construction period. Some impacts would be long-term effects (e.g., visual resources) as is described more fully in the impact analysis text in Chapter 4.

Potential adverse environmental impacts associated with project construction activity would include:

Land Use impacts, including disruption to established grazing and recreational uses in the project vicinity as a result of excavation, blasting, soils movement, grading, recontouring of slopes, and other construction activity;

Vegetation and Wildlife impacts, including temporary and permanent filling of wetlands, as well as potential killing or injury of special-status plant and animal species in the project area, as a

result of truck traffic and equipment operation, soils movement, sedimentation, erosion, runoff, or hazardous materials release;

Fisheries and Aquatic Habitat impacts, within the reservoir and nearby creeks, as a result of equipment operation, soils movement, sedimentation, erosion, runoff or hazardous materials release, affecting water quality and/or aquatic habitat, as well as fish;

Hydrology impacts (i.e., changes in flow rates) within Alameda and Calaveras Creeks during certain periods of construction, resulting in changes in flow velocity, quantity, and channel morphology;

Water Quality impacts in the reservoir and creeks, consisting of changes in water quality parameters (turbidity, temperature, dissolved oxygen, nutrients) as a result of equipment operation, soils movement, sedimentation, erosion, runoff, or hazardous materials release;

Hazards and Hazardous Materials impacts, either through excavation of potentially hazardous substances or through accidental spills, causing release of or exposure to hazardous materials;

Cultural Resource impacts resulting from excavation;

Visual Resources impacts resulting from excavation of large quantities of borrow material from hillsides and other natural areas in the project area;

Transportation and Circulation impacts through reduction in roadway capacity, increases in truck and other construction vehicle traffic, impaired access, and wear and tear on roads;

Air Quality impacts due to construction-related emissions or releases of air pollutants and precursors, resulting from equipment operation, truck and vehicle traffic, excavation, soils movement, and grading; and

Noise impacts from construction equipment and activity (e.g., excavation, loading, blasting, hauling), including nighttime construction activity.

1.5.2 RESTORATION OF RESERVOIR WATER LEVEL

Restoring the reservoir water level from its current DSOD restricted level of 705 feet to its pre-DSOD restricted level of 756 feet would increase not just the reservoir depth, but also the areal extent of the surface of the reservoir. As a result of this increase in reservoir depth and surface area, some areas around the perimeter of the existing reservoir that are presently within or above the zone of fluctuating water depth would become largely submerged in the future. Some areas that are presently above the current reservoir high water line would be within a future zone of

fluctuating water levels and would therefore become periodically or permanently wetted at certain periods of the year during future operations.

Potential adverse environmental impacts associated with the change in reservoir water level would include:

Vegetation and Wildlife impacts, including potential flooding of wetlands, as well as disruption or harm to special-status plant and animal species in the project area, as a result of permanently submerging, periodically inundating and occasionally wetting areas around perimeter of existing reservoir that are presently above the reservoir water level;

Fisheries and Aquatic Habitat impacts, within the reservoir and creek upstream of the reservoir, as a result of changes in reservoir water levels, water quality parameters, shoreline habitat and connection with an upstream creek;

Cultural Resources impacts on known archaeological resources and unknown paleontological resources as a result of the change in reservoir water levels; and

Water Quality impacts in the reservoir as a result of new water depths (changes in water quality parameters, such as temperature, nutrients, and dissolved oxygen) and new water levels, putting the reservoir in contact with borrow materials containing metals or other contaminants.

1.5.3 FUTURE OPERATIONS

Proposed future operations of the ACDD and the Calaveras Dam and Reservoir are summarized above in Section 1.4.4, Project Operation. Pursuant to a 1997 MOU with the CDFG, up to 6,300 AF per year of water would be released by the SFPUC into Alameda and/or Calaveras Creeks for enhancement of fisheries and other natural resources of the creeks. These flows would be released to Alameda Creek, to the extent available, through the proposed bypass tunnel at the ACDD. When sufficient minimum flows are not available in Alameda Creek at the ACDD, water would be released from Calaveras Dam into Calaveras Creek to meet the MOU requirements, through the proposed low-flow valves. Additionally, the SFPUC and several other public agencies and private and non-profit organizations are undertaking efforts to restore the historic steelhead run in Alameda Creek. As part of that effort, the SFPUC proposes to implement additional flow release schedules when steelhead have regained access to the upper Alameda Creek watershed upstream of the BART weir as determined by NMFS.

Environmental impacts associated with future reservoir operations would include:

Hydrology – Operational effects on flows, channel formation, and sedimentation in Alameda and Calaveras Creeks would be within the range of pre-project conditions. In general, on an average annual basis, there would be a reduction in flows within Calaveras Creek in some winter months

and an increase in flows during most other months of the year. Within Alameda Creek, on an average annual basis, there would be a decrease in flows in some winter months and an increase in flows in other months. Overall, within both creeks, the project would result in a slight increase in flows on a net annual average basis and maintain periodic peak flows.

Vegetation and Wildlife – Operation of the proposed project would improve habitat conditions for aquatic wildlife within certain reaches of Alameda and Calaveras Creeks by providing more stable and reliable habitat during sensitive periods. These improvements would benefit sensitive native species, including California red-legged frog and foothill yellow-legged frog, but would also benefit predatory non-native bullfrogs.

Fisheries and Aquatic Habitat – The EIR has identified no adverse environmental impacts on fisheries and aquatic habitat that would result from the proposed releases of water described above. The proposed releases would likely provide a more stable and reliable habitat for fish, and higher magnitude channel maintenance flows would continue similar to existing conditions.

1.5.4 MITIGATION MEASURES

For virtually all of the potential environmental impacts identified above, mitigation measures have been identified that would reduce the impacts to a level that the EIR concludes would be less than significant. These mitigation measures vary by environmental issue and include detailed and comprehensive measures regarding construction equipment use, and construction practices and activity; pre-construction surveys, information-gathering and site preparation; avoidance of impacts on species, habitat restoration, compensation, monitoring, and adaptive management; implementation of Best Management Practices for storm water pollution prevention; hazardous materials assessment, handling, and monitoring; cultural resources evaluation, monitoring, and treatment; traffic control and road repair; dust and exhaust emissions controls; and noise control measures.

Many of the specific mitigation measures described in the EIR would involve participation and approval of other regulatory agencies regarding final specific mitigation and/or permitting details (e.g., RWQCB regarding the storm water pollution prevention plan; BAAQMD regarding the dust mitigation plan; CDFG, NMFS, and USFWS regarding plans to mitigate potential impacts on sensitive species).

While most project impacts could be mitigated to less-than-significant levels, as discussed in more detail below in Section 1.7, the EIR concludes that the project would have significant unavoidable impacts (i.e., significant impacts that could not be mitigated to a level of less than significant) with regard to visual resources and construction-related transportation and nighttime noise. The EIR also concludes that, while the impacts of emissions of ozone precursors and greenhouse gases during construction could be mitigated to less-than-significant levels under

existing BAAQMD thresholds, these impacts would be significant and unavoidable under newly proposed BAAQMD thresholds for construction-related emissions.

Table S.2 presents a summary of the proposed project's impacts and mitigation measures. The topics in the table follow the order and numbering scheme of the sections in Chapter 4 and Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project. Each mitigation measure is numbered to correspond to the impact it addresses. The levels of significance for the impacts are designated by the following abbreviations:

- LS – An impact that is “less than significant” (LS) does not rise to the applicable significance threshold. No mitigation is necessary.
- S – An impact that is “significant” (S) rises to the applicable significance threshold.
- LSM – An impact that is “less than significant with mitigation” (LSM) is a potentially significant impact that would be reduced to a less-than-significant level with implementation of feasible mitigation measures, identified in Chapter 5.
- SU – An impact that is “significant and unavoidable” (SU) is a potentially significant impact for which implementation of feasible mitigation measures would still not reduce the impact to a less-than-significant level, or for which feasible mitigation measures are not available.
- B – An impact that is “beneficial” (B) would improve physical environmental conditions compared to the baseline.
- NI – No change in environmental condition would occur, and the project is determined to have no effect or “no impact” (NI).

1.5.5 CUMULATIVE IMPACTS

In addition to project-specific environmental impacts, the EIR also analyzes the potential for the proposed project to result in cumulative impacts, i.e., the potential for the project-specific impacts to combine with impacts from other projects (WSIP projects and other projects in the project vicinity) such that the combined environmental impacts are potentially significant.

The EIR concludes that the project could contribute considerably to potential significant cumulative impacts with respect to sensitive biological resources, fisheries and aquatic habitat, water quality, hazardous materials, cultural resources, traffic and circulation, air quality and noise. However, the EIR identifies mitigation measures that could reduce the project's contribution to cumulative impacts such that the project, as mitigated, would not result in a considerable contribution to significant cumulative impacts, except in the area of air quality based on proposed BAAQMD thresholds of significance.

With respect to potential future cumulative impacts on Central California Coast Steelhead, in addition to the flow release schedules proposed for resident rainbow trout, the SFPUC proposes to implement instream flow schedules to support steelhead. The steelhead flow schedules will be

implemented in the event barriers in lower Alameda Creek are remedied and steelhead regain access upstream of the BART weir as determined by NMFS.

As discussed in Section 6.1, Growth Inducement, in Chapter 6, Other Topics Required by CEQA, the proposed project is one of several improvement projects that comprise the SFPUC's WSIP. Implementation of the WSIP would assist in removing water supply as an obstacle to growth in the SFPUC service area, thereby contributing indirectly to environmental impacts caused by that growth. Because the proposed project is part of the WSIP and would contribute to the WSIP's growth inducement impact, the project would contribute to the significant and unavoidable program-level impacts associated with growth inducement. See PEIR Chapter 7, which is incorporated into this EIR by this reference, and summarized in this EIR in Section 6.1, Growth Inducement, in Chapter 6.

In addition, because the proposed project is part of the WSIP, the WSIP PEIR found that it would also contribute to the following significant and unavoidable impacts: effects in the Peninsula watershed on fishery resources in Crystal Springs Reservoir in San Mateo County; and effects on stream flow in Alameda Creek between the diversion dam and the confluence with Calaveras Creek. See PEIR Chapters 5 and 6, which are incorporated into this EIR by this reference, and summarized in this EIR in Section 6.3, Significant Environmental Effects That Cannot Be Avoided if the Proposed Project Is Implemented, in Chapter 6. Subsequent analysis for the CDRP EIR (see Section 4.6, Hydrology) has determined that the impact on hydrology of Alameda Creek between the diversion dam and the confluence with Calaveras Creek is less than significant. Other impacts on the Alameda Creek watershed related to the CDRP that were analyzed in the PEIR also have been re-evaluated in this EIR. All other impacts resulting from implementation of the WSIP can be mitigated to less-than-significant levels.

1.6 ALTERNATIVES TO THE PROPOSED PROJECT

As stated in CEQA Guidelines Section 15126.6 (a), "an EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project, but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives."

A range of alternatives that could feasibly meet most of the basic objectives of the proposed project were evaluated by the SFPUC. Because the basic objectives of the proposed project are to restore the water storage capacity of the existing Calaveras Reservoir and to improve the seismic safety of the existing dam, the development of suitable alternatives is more constrained than for projects involving construction of new facilities. Thus, the range of potential alternatives includes alternatives for components of the proposed project. The following alternatives are evaluated in the EIR in Chapter 7, Alternatives to the Proposed Project:

- Alternative 1: No Project
- Alternative 2: Off-Site Disposal
- Alternative 3: Off-Site Borrow
- Alternative 4: Consolidated On-Site Disposal
- Alternative 5: New Downstream Dam without Provision for Potential Future Enlargement
- Alternative 6: Replacement Dam at Existing Location

Several additional alternatives were identified but rejected from further consideration in the EIR. These alternatives are various alternative locations for water storage, and a larger dam and reservoir. The reasons for rejecting these alternatives are summarized in Section 7.10, Alternatives Considered and Rejected.

CEQA requires identification of the environmentally superior alternative. If the No Project Alternative is the environmentally superior alternative, the EIR shall also identify an environmentally superior alternative among the remaining alternatives analyzed (CEQA Guidelines Section 15126.6(e)(2)). Each of the alternatives analyzed in this EIR has environmental impacts. Alternative 5, New Downstream Dam without Provision for Potential Future Enlargement, is considered to be the environmentally superior alternative. Alternative 5 would reduce some construction-related impacts of the proposed project due to the approximately 11 percent less material required to construct it, and is the only alternative that would not result in new or increased significant impacts in comparison to the CDRP. It would meet most of the CDRP's objectives. It would not meet the primary objective of constructing a new dam with a robust design that could accommodate potential enlargement by future generations.

A comparison of the impacts of the alternatives to those of the proposed project is provided in Table 7.2 in Chapter 7 of the EIR.

1.7 OTHER CEQA REQUIRED TOPICS

As stated above, growth-inducing effects are discussed in Section 6.1, Growth Inducement, in Chapter 6. Cumulative impacts of the proposed project in combination with other projects proposed by the SFPUC and others in the Sunol Valley are discussed in Section 6.2, Cumulative Impacts, in Chapter 6.

The significant impacts described in Chapter 4, Environmental Setting and Impacts, could be mitigated to less-than-significant levels with implementation of mitigation measures identified in this Draft EIR, with the exception of impacts on visual resources and construction-related transportation, air quality, and nighttime noise impacts, discussed below.

Construction activities and modifications to physical conditions on the project site after the project is complete would result in substantial adverse effects on views from some areas of the

Sunol Wilderness Regional Preserve area that is north and east of the project site, resulting in significant and unavoidable impacts. Excavation of the peak of Observation Hill and Hill 1000 for the new spillway, and Borrow Area B to obtain construction materials for the new dam, would permanently alter ground profiles, texture, patterns, and color of the hillsides visible from hiking trails in the Sunol Wilderness. Loss of vegetation in excavation areas would be partly mitigated by revegetation programs, but the areas would take decades to recover and would not return to existing cover characteristics. Therefore, this visual impact is considered significant and unavoidable, as described in Section 6.3, Significant Effects That Cannot Be Avoided if the Proposed Project Is Implemented.

Construction activities would occur during hours beyond the time limits specified in the Alameda County and Santa Clara County noise ordinances. Construction activities occurring beyond the ordinance time limits would not, for the most part, exceed ordinance noise limits at the closest residential receptors. However, it is possible that back-up beepers could exceed the Santa Clara County Noise Ordinance nighttime limit if multiple pieces of equipment are in use at the same time in Borrow Area E and Staging Area 11 at the south end of the reservoir. This could cause significant noise impacts at the nearest residential receptors, especially if windows were open in residences. Mitigation measures would reduce most construction noise impacts to less-than-significant levels. However, back-up beepers could still exceed ordinance limits during the nighttime hours. Therefore this impact is identified as significant and unavoidable in Section 6.3.

Construction-related traffic on Calaveras Road would have a significant traffic safety impact on motorists, bicyclists, and pedestrians. Implementation of a Traffic Control Plan in accordance with Mitigation Measure 5.12.4a and temporary closure of a portion of Calaveras Road under Mitigation Measure 5.12.4b would reduce this impact to a less-than-significant level. However, if Alameda County does not permit the temporary closure of the portion of Calaveras Road from Geary Road to the dam site, implementation of this provision of Mitigation Measure 5.12.2 would not be feasible. Therefore, the impact of the CDRP on traffic safety hazards during project construction is potentially significant and unavoidable.

Construction activities would result in emissions of reactive organic gasses (ROG) and nitrogen oxides (NO_x) (both ozone precursors), and fine particulate matter (PM₁₀ and PM_{2.5}), at levels that would not exceed existing BAAQMD thresholds but would exceed proposed BAAQMD thresholds. Mitigation measures identified in Section 5.14, Air Quality Mitigation Measures, would not reduce these significant impacts to less-than-significant levels based on the proposed thresholds. Therefore, construction-related emissions of ozone precursors, PM₁₀, and PM_{2.5} are considered to result in significant unavoidable impacts. Project construction activities would also likely exceed the draft Option 2 threshold of significance proposed by the BAAQMD for greenhouse gas (GHG) emissions. The project's GHG emissions would contribute considerably

to significant cumulative GHG emissions. The project's air quality impacts would be significant and unavoidable based on proposed BAAQMD thresholds.

1.8 AREAS OF CONTROVERSY AND ISSUES TO BE RESOLVED

The public scoping process for this EIR occurred in autumn 2005. A Notice of Preparation was published in October 2005 (see Appendix A, Notice of Preparation), and two public scoping meetings were held on November 14 and 15, 2005. A scoping report was prepared that includes a summary of the issues raised at the scoping meetings and in writing during the public scoping period (see Appendix B, Public Scoping Process Summary Report). The report includes transcripts of the presentations and oral testimony at both public meetings and copies of written comments received.

Comments from public agencies and the concerned public included many issues that are addressed in this Draft EIR. Some comments were presented that raise issues related to existing conditions on Calaveras and Alameda Creeks that pre-date the proposed project and are not related to the potential environmental impacts that could result from implementing the proposed project. These issues include concerns regarding barriers to fish passage in Alameda Creek. The EIR considers all environmental effects of the project, including the future cumulative effect of the project on steelhead in the upper Alameda Creek area in the event barriers in lower Alameda Creek are removed in the future and steelhead gain access to this area. Other issues related to restoration of steelhead in the watershed have been the subject of ongoing efforts by the SFPUC to resolve in other forums. The major environmental concerns raised during the scoping period include:

- Requests to remove dams on upper Alameda Creek and Calaveras Creek or provide fish passage structures to allow fish to reach spawning areas.
- Preservation of the existing population of resident trout.
- Opportunities for restoration of fish habitat.
- Opportunities for restoration of steelhead trout population.
- Requests to provide for releases of water from Calaveras Dam and the ACDD to improve fish habitat.
- Impacts on trout resident in Calaveras Reservoir.
- Impacts on vegetation and wildlife resources in the project area and opportunities for restoration of habitat.
- Impacts on water quality in Alameda Creek and Calaveras Creek during construction.
- Noise impacts during construction.
- Air quality impacts during construction.
- Impacts on circulation and traffic from truck traffic during construction.
- Impacts on recreational users in nearby recreation areas during construction.

- Impacts on cultural resources from filling the reservoir after construction of a new dam.
- Need for an alternative providing a larger dam and reservoir for regional water supplies.
- Impacts on water supply for downstream users.
- Consideration of an alternative without the proposed larger core that would support an increase in reservoir size in the future.

Table S.2: Summary of Impacts and Mitigation Measures

	Impact	Level of Significance* Before Mitigation	Mitigation Measure	Level of Significance* After Mitigation
4.3 Land Use, Agricultural Resources, and Recreation				
4.3.1	Impact of construction activities on the existing character of the vicinity of the proposed project.	LS	No mitigation necessary.	LS
4.3.2	Impact of project operations on existing and/or planned land uses in the vicinity of proposed facilities.	LS	No mitigation necessary.	LS
4.3.3	Consistency of proposed project with applicable land use plans, policies, and regulations adopted to avoid environmental impacts.	LS	No mitigation necessary.	LS
4.3.4	Impact of construction activities on grazing land.	LS	No mitigation necessary.	LS
4.3.5	Impact of project operations on agricultural uses in the project vicinity.	LS	No mitigation necessary.	LS
4.3.6	Impact of construction activities on established recreational uses in the vicinity of the proposed project site.	S	5.3.6 AMGEN Tour of California The San Francisco Public Utilities Commission (SFPUC) shall coordinate with the organizers of the AMGEN Tour of California bicycle tour to ensure that temporary road closures, haul truck traffic, and other activities related to project construction will not interfere with the tour. Construction activities may be temporarily suspended as needed to prevent conflicts with the AMGEN tour. See also Transportation and Circulation Mitigation Measure 5.12.4a, Hazards and Hazardous Materials Mitigation Measure 5.9.2a, and Air Quality Mitigation Measure 5.13.1a.	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.4 Vegetation and Wildlife			
4.4.1 Effect of CDRP on wetlands and other aquatic habitats.	Construction: S Filling: S Operation: LS	5.4.1 Avoidance and Minimization Measures The SFPUC and its contractors shall implement the following measures to avoid and minimize potential impacts of the proposed project on special status species and sensitive habitats. These measures apply to both on-site construction and off-site mitigation areas. 5.4.1a Pre-Construction Measures • Wetland Buffers. Except for those areas specifically identified in Table 4.4.9, Impacts of Construction on Wetlands and Other Waters of the State and United States, where impacts cannot be practicably avoided, a minimum 100-foot buffer surrounding all wetlands, ponds, streams, drainages, and other aquatic habitats located on or within 100 feet of the project site shall be clearly designated on the final project construction plans and marked on the site with orange construction fencing or silt fence. If the area is on a slope, silt fencing or other comparable management measures will be installed to prevent polluted runoff, as well as equipment, from entering the buffer area. Signs shall be installed every 100 feet on or adjacent to the buffer fence that read, "Environmentally Sensitive Area – Keep Out." Fencing and management measures shall be installed and inspected prior to initial project construction and maintained through the construction period. No equipment mobilization, grading, clearing, storage of equipment or machinery, vehicle or equipment washing, or similar activity, may occur until a representative of the SFPUC has inspected and approved the fencing and/or management measures installed around these features. • Temporary Stream Crossings. The final project construction plans shall be designed to minimize the number of temporary stream crossings necessary for project site access and construction. Stream crossings shall be located to the maximum extent practicable in previously disturbed areas lacking riparian vegetation, pools, side ponds, or other sensitive habitat features. • Worker Education Program. A worker education program shall be implemented to familiarize workers, including all vehicle operators, of the importance of avoidance of harm to special-status species and sensitive natural communities. The training shall include a discussion of the importance of maintaining speed limits	LSM LSM LS

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		and respecting exclusion zones. The SFPUC and its construction contractor shall confirm that all workers have been trained appropriately. Aquatic Habitat Pre-construction Survey. For 2 weeks prior to the commencement of work activities and immediately prior to commencement of work, a qualified biologist will survey aquatic habitat that is suitable for the California red-legged frog, California tiger salamander, foothill yellow-legged frog, and western pond turtle and that would be affected by the project. If individuals in any life stages of these species are found, the biologist will contact the U.S. Fish and Wildlife Service (USFWS) and/or California Department of Fish and Game (CDFG) to determine whether relocating any life stages is appropriate. The aquatic habitat areas that cannot feasibly be avoided during project construction (Table 4.4.9, Impacts of Construction on Wetlands and Other Waters of the State and United States), will be dewatered prior to construction (except Calaveras Reservoir). Areas that would be dewatered (assuming seasonal flows or water is present) are Pond 9 and freshwater marsh, and perennial streams, including Calaveras Creek downstream of the dam. A qualified full-time monitor will be present until ponds and streams are fully dewatered. Intake screens will not exceed a mesh size of 5 millimeters. If any of these species are found during dewatering, the qualified biologist will contact the USFWS and/or CDFG to determine whether relocating individuals during any life stages is appropriate. The qualified biologist will remove and/or destroy any individuals of non-native species, such as bullfrogs, crayfish, and centrarchid fishes from within the dewatered habitat, to the maximum extent possible. California Tiger Salamander Pre-construction Survey. A preconstruction survey will be conducted at each work site where there would be ground-disturbing activities to identify suitable California tiger salamander burrow aestivation areas. Aestivation habitat will be defined as the presence of two or more small mammal burrows greater than 1 inch in diameter within a 10-foot-diameter area and within 10 feet of proposed construction sites (i.e., the presence of a single isolated gopher hole would not be considered habitat). As feasible within the context of the work area, aestivation areas will be temporarily fenced and avoided. A California tiger salamander salvage and relocation plan will be prepared in coordination with USFWS and CDFG. A qualified biologist will carry out the salvage and relocation operations at construction sites where upland habitat has	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		been identified. Surveys and trapping of California tiger salamanders will occur in the rainy season prior to construction. The effort shall be appropriately timed with respect to salamander activity for the year and proposed construction activities. Drift fences and pitfall traps within or on the perimeter of construction sites will be used to capture and relocate animals to suitable areas nearby that will not be affected by construction. USFWS trapping protocols will be followed. Exclusion fencing (described in Mitigation Measure 5.4.2, Construction Measures) will be regularly maintained and monitored until the start of and throughout construction. • Johnny Jump-up. Prior to commencement of ground-disturbing activities, a qualified botanist shall flag and oversee fence installation around all stands of Johnny jump-up (<i>Viola pedunculata</i>) mapped during studies for this project (ETJV 2006 and Entomological Consulting Services 2004) within the construction footprint that can be avoided. These fenced areas shall be avoided during construction. • Bald Eagle Pre-construction Survey. A qualified biologist will conduct monitoring in the months of December, January, and February, before construction begins, to determine whether bald eagles are nesting at Calaveras Reservoir. A minimum 660-foot no-disturbance buffer will be established around any active bald eagle nest near the construction site. If an active bald eagle nest is observed within 660 feet of the west haul road, the haul route would not be used without additional coordination with USFWS and CDFG. If the project cannot be altered to ensure that project construction, including the use of the barge haul route, would avoid potentially causing a bald eagle nest to fail, SFPUC will coordinate with CDFG and USFWS to determine whether hazing measures may be appropriate.² Hazing measures (e.g., frequent human activity at the nest site, use of loud noises at nest trees) would be implemented to prevent use of the nest only if egg laying had not yet commenced and would be implemented early enough in the nesting season for the eagles to use an alternate location. If hazing is not effective, a structure to exclude bald eagles from any constructed nests	

² This is a precautionary measure included in the event that a new bald eagle nest location that cannot feasibly be avoided is established within 660 feet of the project footprint prior to construction.

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		(e.g., a cone-shaped enclosure that would preclude eagles from accessing the nest) may be installed. Take authorization, if allowed, under the Bald and Golden Eagle Act³ would be required for such measures. Ground-nesting Raptor, Burrowing Owl and Northern Harrier Pre-construction Surveys. No more than 2 weeks before construction, a survey for ground-nesting raptors, burrowing owls and northern harriers, will be conducted by a qualified biologist in suitable habitat within 500 feet of the project. Surveys will also be conducted through the reservoir refilling period in suitable habitat in the area that would be inundated by the reservoir. Surveys will conform to the protocol described by the California Burrowing Owl Consortium, which includes up to four surveys on different dates if there are suitable burrows present (Burrowing Owl Consortium 2009). This protocol would be suitable to identify northern harrier nests concurrent with burrowing owl surveys. If occupied owl burrows or harrier nests are found within the survey area, a determination will be made by a qualified biologist, in coordination with the CDFG, as to whether or not work or refilling of the reservoir will disrupt reproduction. If it is determined that construction will not affect occupied burrows or northern harrier nests or disrupt breeding behavior, construction will proceed without any restriction or mitigation measures. If it is determined that construction or refilling of the reservoir will affect occupied burrows during August through February, subject owls will be passively relocated from the occupied burrow(s) using one-way doors installed at the entrance. There will be at least two unoccupied burrows suitable for burrowing owls within 300 feet of the occupied burrow (or the limit of construction or re-filling) before one-way doors are installed. Artificial burrows will be in place at least 1 week before one-way doors are installed on occupied burrows. One-way doors will be in place for a minimum of 48 hours before burrows are excavated.	

³ Currently, there is no regulatory mechanism in place under the Bald and Golden Eagle Act that permits take of bald or golden eagles comparable to under the federal Endangered Species Act (FESA). USFWS has proposed to add a new section at Title 50 of the Code of Federal Regulations, Section 22.26, to authorize the issuance of permits to take bald and golden eagles on a limited basis. In comparison with requirements under FESA, the permitting process proposed under the Eagle Act is expected to be less burdensome to comply with while continuing to provide appropriate protection for bald and golden eagles. Take of bald or golden eagles would be authorized only where it is determined to be compatible with the preservation of bald and golden eagles and cannot practicably be avoided (USFWS 2007, p. 31141).

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		If it is determined that construction will physically affect occupied owl burrows or active northern harrier nests or disrupt reproductive behavior during the nesting season (March through July), then avoidance is the only mitigation available. Construction will be delayed within 300 feet of occupied owl burrows or northern harrier nests until it is determined that the subject owls or harriers are not nesting or until a qualified biologist determines that juvenile owls or harriers are self-sufficient or are no longer using the natal burrow or nests as their primary source of shelter. Alternatively, other appropriate avoidance measures, as approved by CDFG may be implemented to ensure that the nest is protected. If it is determined that reservoir refilling will flood occupied burrows or active nests, or disrupt reproductive behavior during the nesting season (March through July) then SFPUC will, subject to approval by CDFG, prevent the death of viable eggs or young by relocating them to an appropriate wildlife care facility or implementing other measures recommended by CDFG. • Other Tree-Nesting Raptor Pre-construction Survey. A survey to identify active nests for tree-nesting raptors (other than bald eagles) will be conducted by a qualified biologist no more than 2 weeks before the start of construction at project sites from February 1 through July 30. Active raptor nests located within 500 feet (0.25 mile for golden eagle) of the project will be mapped, to the extent allowed by access. If an active raptor nest is found within 500 feet (0.25 mile for golden eagle) of the project, a determination will be made by a qualified biologist, in coordination with the CDFG, as to whether or not construction work will affect the active nest or disrupt reproductive behavior. Criteria used for this evaluation will include, but not be limited to, presence of visual screening between the nest and construction activities, and behavior of adult raptors in response to the surveyors or other ambient human activity. Alternatively, other appropriate avoidance measures, as approved by CDFG may be implemented to ensure that the nest is protected. If it is determined that construction will not affect an active nest or disrupt breeding behavior, construction will proceed without any restriction or mitigation measure. If it is determined that construction will affect an active raptor nest or disrupt reproductive behavior, then avoidance is the only mitigation available. Construction will be delayed within 300 feet (0.25 mile for golden eagle) of such a nest until a qualified biologist determines that the subject raptors are not nesting.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		In coordination with CDFG, trees with unoccupied raptor nests (excluding golden and bald eagle) may only be removed prior to March 1 or following the determination that subject raptors are not nesting. Loggerhead Shrike, Grasshopper Sparrow, and Tricolored blackbird Pre-construction Surveys. Pre-construction surveys shall be conducted by a qualified biologist, in suitable habitat, for loggerhead shrike, grasshopper sparrow, and tricolored blackbird no more than 14 days prior to the beginning of any construction activity between March 1 and August 15. The survey area shall include all potential nesting sites located within 100 feet of the area to be disturbed. If an active nest of one of these species is found within 100 feet of the project, a determination will be made by a qualified biologist, in coordination with the CDFG, as to whether or not construction work will affect the active nest or disrupt reproductive behavior. Criteria used for this evaluation will include, but not be limited to, presence of visual screening between the nest and construction activities, and behavior of the adult birds in response to the surveyors or other ambient human activity. If construction activities have the potential to threaten the viability of an active nest discovered during the survey, then either a minimum 100-foot buffer will be flagged around the active nest and designated a construction-free zone until the nest is no longer active or other appropriate avoidance measures, including a reduced buffer size, approved by CDFG, are implemented to ensure that the nest is adequately protected. Exact implementation of this measure shall be based on specific information at the project site. Swallow Exclusion. At least 6 months prior to the start of construction, a qualified biologist shall identify swallow colonies nesting within 100 feet of construction areas. During the months of September through February, a qualified biologist shall supervise the installation of netting or screens to prevent colonies from becoming established on or near structures or cliffs that would be destroyed by construction (after verifying that no swallows would be trapped). Bat Exclusion. At least 6 months prior to the start of construction, a qualified biologist shall identify potential bat maternity sites within 500 feet of construction areas. During the months of November through February, a qualified biologist shall supervise the installation of screens at potential roosts to prevent bat use (after verifying that no bats would be trapped by screening).	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		If potential maternity roost sites cannot be screened in advance, pre-construction surveys shall be conducted by a qualified biologist, in suitable rock outcrop and developed habitat for Townsend's big-eared bat, pallid bat, and western mastiff bat, no more than 14 days and no less than 7 days prior to the beginning of any construction activity between March 1 and October 31. The survey area shall include all potential maternity sites located within 500 feet of the area to be disturbed. If an active maternity site is found within 500 feet of the project, a determination will be made by a qualified biologist, in coordination with the CDFG, as to whether or not construction work will affect the site or disrupt reproductive behavior. Criteria used for this evaluation will include, but not be limited to, presence of visual and audio screening between the site and construction activities. If construction activities have the potential to threaten the viability of an active maternity site discovered during the survey, then a minimum 500-foot buffer will be flagged around the site and designated a construction-free zone until the site is no longer active or other appropriate avoidance measures, including a reduced buffer size, approved by CDFG, are implemented to ensure that the site is adequately protected. Exact implementation of this measure shall be based on specific information at the project site. • Most Beautiful Jewel-flower Buffer. Before the initiation of any ground-disturbing or vegetation-clearing activities at Disposal Site 7 and Disposal Site 7 haul roads, a qualified botanist shall supervise the installation of barrier fencing on the perimeter of the work area within 200 feet of mapped most beautiful jewel-flower populations and Diablo helianthella populations. Signs shall also be installed every 100 feet on the fence line to identify the sensitive area (e.g., "Environmentally Sensitive Area – Keep Out"). No construction-related activities shall be permitted within the limits of the populations. The contractor shall maintain the fencing throughout construction of the CDRP. 5.4.1b Construction Measures • Wetlands and Other Waters. Construction activities shall be avoided in saturated or ponded wetlands and streams (typically during the spring and winter) to the maximum extent practicable. Where wetlands or other water features must be disturbed, the minimum area of disturbance necessary for construction shall be identified and the area outside of that minimum area shall be avoided.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Exclusion Fencing. The SFPUC shall ensure that the temporary exclusion fencing and/or other protective measures are continuously maintained until construction activities in the area of interest are completed. Exclusion fencing for establishing protective buffers shall be clearly visible (e.g., orange plastic). Barrier fencing for the California tiger salamander and Alameda whipsnake may be constructed of various materials but shall be buried deep enough (6–8 inches) and shall be tall enough (at least 24 inches above ground) to prevent the passage of target species. No construction activities, including movement of equipment, storage of materials or temporary stockpiling of spoils, will be allowed within fenced areas protecting sensitive habitats. All exclusion fencing shall be removed at the end of construction activities. • Wetland Soils and Vegetation. To minimize the degradation of saturated wetland soils and vegetation where avoidance is not practicable, protective practices such as use of geotextile cushions and other materials (e.g., timber pads, prefabricated equipment pads, thick vegetative slash, geotextile fabric) and/or vehicles with balloon tires will be employed. • Streams and Drainages. Stabilize banks of all streams and drainages disturbed during construction, including banks of Alameda and Calaveras Creeks, using a non-vegetative material that will protect the soil from erosion by wind or water initially and break down within a few years (e.g., jute mat). If visual evidence of erosion (e.g., rilling or scour) is observed, geotextile mats, excelsior blankets, or other soil stabilization products shall also be used. • Vegetation Removal. During construction, remove trees, shrubs, debris, soils, or construction materials that are inadvertently deposited below the ordinary high-water mark of any streams, drainages, ponds, wetlands, riparian areas, and Calaveras Reservoir in a manner that minimizes disturbance of the drainage bed and bank (e.g., manually). Such materials will be set back at least 10 feet from Calaveras Reservoir and from streams, drainages, ponds, wetlands, and riparian areas that are not otherwise directly disturbed by construction. • Stream Crossing Locations. Whenever possible, stream crossings shall be located on straight, relatively flat stream segments.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Use of Stream Crossings. Stream crossing construction activities shall be timed to minimize impacts on wildlife and fish, including but not limited to the foothill yellow-legged frog. Installation or removal of crossings shall occur during dry conditions, preferably in summer when water flows are minimal. If necessary, stream flow shall be diverted through temporary culverts, conduits or like feature while stream crossings are being installed. Diversion culverts or conduits shall be sized to accommodate flows from flash flooding. • Culvert Design. Culverts for temporary stream crossings in fish-bearing streams must allow for fish passage, and the outflow of the culvert shall not create a waterfall. If possible, install and remove culverts when the streambed is dry. In a flowing stream channel, use sediment basins, a temporary diversion channel, or a dam and pump set-up to divert water during installation and removal of culverts. • Construction of Stream Crossings. Temporary stream crossings constructed using temporary bridges shall have clean gravel/cobbles and topped with a gravel road base. Earth and rockfill material shall not be placed in stream channels. Approaches shall be stabilized using an appropriate type of geotextile covered with clean rock. Material shall extend at least 50 feet on both sides of the crossing if soft soil conditions exist or if they will be used for construction traffic during the rainy season. • Alameda Whipsnake Avoidance. Vegetation clearing and initial ground disturbance activities in stands of scrub habitat that are potentially occupied by Alameda whipsnake and that cannot be avoided will be monitored by a qualified biologist. The biologist will conduct surveys and relocate any whipsnakes immediately prior to equipment clearing. Prior to clearing, escape routes that include natural vegetative cover will be provided to allow Alameda whipsnakes to move from the scrub habitat to other habitat outside of the construction area. Stands of Alameda whipsnake scrub habitat that cannot be avoided will be hand-cleared, or a qualified biologist will do surveys and relocate any whipsnakes immediately prior to equipment clearing. Prior to clearing, escape routes that include natural vegetative cover shall be provided to allow Alameda whipsnakes to move from the scrub habitat to other habitat outside of the construction area.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		Trenches or pits constructed in scrub or rock outcrop habitat will include escape ramps constructed of earthfill or wooden planks inspected by a qualified biologist to prevent entrapment of Alameda whipsnake and other animals. SFPUC will install barrier fencing at selected locations to exclude Alameda whipsnakes from entering construction areas, haul roads, and access roads. Fencing locations will be based on observations of Alameda whipsnakes or the presence of habitats that are likely to support higher densities of this species. Other portions of the haul route and construction work areas would not be fenced, based on coordination with CDFG and USFWS. SFPUC shall monitor disturbance areas to determine whether additional fencing is necessary to minimize potential impacts. Also see Vegetation and Wildlife Mitigation Measures 5.4.2 and 5.4.3.	
4.4.2 Effect of CDRP on California red-legged frog.	Construction: S Filling: S Operation: S	5.4.2 Habitat Restoration Measures The SFPUC shall restore the habitat functions and services of areas that are subject to temporary disturbance during project construction. Site restoration shall be undertaken in accordance with a detailed restoration plan or plans prepared by a qualified restoration ecologist and shall be consistent with all required permits. The final habitat restoration plan or plans shall provide, at minimum: 5.4.2a Habitat Restoration Goals and Objectives - Restore temporary impacts on wetlands, streams and riparian habitat located above the 756-foot inundation elevation within the reservoir, as well as downstream of the replacement dam and within the limit of work at Calaveras Creek within 3 years of completion of construction. - Restore temporary impacts on annual grasslands within the limit of work located above the 756-foot inundation elevation within 3 years of completion of construction. 5.4.2b Restoration Plan The final habitat restoration plan(s) shall include detailed written specifications and work descriptions for the restoration projects, including, as applicable but not limited to: the geographic boundaries of the projects; construction methods; timing and sequence; sources of water, including connections to existing waters and uplands; soil properties (e.g., particle size, organic content); methods for establishing the desired plant	LSM LSM LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		communities; plans to control invasive plant species; dewatering information, if applicable; proposed grading plans, including elevations and slopes of the substrate; soil management; and erosion control measures. For stream restoration, the restoration plan(s) shall also include: planform geometry; channel form (e.g., typical channel cross-sections and longitudinal profiles); stream type (i.e., ephemeral, intermittent, or perennial); location in watershed; watershed size (i.e., drainage area); mean annual precipitation; channel-forming discharge (i.e., design discharge); and riparian area plantings. The restoration plan will be completed in coordination with applicable permitting agencies. 5.4.2c Success Criteria, Monitoring, and Adaptive Management The final habitat vegetation restoration plan(s) shall include ecologically based criteria that will be used to determine whether the restoration projects are achieving identified objectives. The success criteria shall be based on attributes that are objective and verifiable. The final restoration plan(s) shall include a description of parameters to be monitored and reported in order to determine whether the restoration projects are on track to meet success criteria and whether adaptive management is needed. A schedule for monitoring and reporting on monitoring results must be included, as determined in coordination with applicable permitting agencies and/or as needed to verify whether the vegetation is fully established and self-sustaining. Also see Vegetation and Wildlife Mitigation Measures 5.4.1, 5.4.3, and Water Quality Mitigation Measure 5.7.1.	
4.4.3 Effect of CDRP on California tiger salamander.	Construction: S Filling: S Operation: LS	5.4.3 Compensation Measures The SFPUC shall compensate for unavoidable impacts on special-status species and sensitive habitats in accordance with a detailed compensation plan or plans. The compensation plan(s) shall be prepared by a qualified restoration ecologist and shall be consistent with all required permits. The final compensation plan(s) shall fully compensate for direct and indirect impacts on special-status species and for the temporal, long-term, and permanent losses of habitat areas, functions, and services and shall include: a description of the resource types and amounts that will be provided; the methods of compensation (i.e., restoration, rehabilitation, re-establishment, establishment, enhancement, and/or preservation); and the manner in which the resource functions and services of the compensation project will address the related project impacts. The final compensation plan(s) shall provide, at minimum:	LSM LSM LS

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		5.4.3a Compensation Goals and Objectives • Wetlands and Other Waters. Fully compensate for impacts on 4.61 acres of wetlands and open water, and 4,682 linear feet of stream habitat by restoring wetlands and streams and establishing wetland habitats at the South Calaveras and San Antonio Mitigation Areas within 5 years of completion of construction. • Riparian Habitat. Fully compensate for impacts on 7.9 acres of riparian habitat by restoring and establishing riparian habitat at the South Calaveras and San Antonio Mitigation Areas within 10 years of completion of construction. • Oak Woodlands and Savannah. Fully compensate for impacts on 24.0 acres of oak woodland and savannah habitat by restoring and establishing oak woodland and savannah habitat at the San Antonio Mitigation Area within 10 years of completion of construction. Impacts on oak woodlands and savannah may also be compensated for in whole or in part through a contribution to the Oak Woodlands Conservation Fund as established under subdivision (a) of Section 1363 of the Fish and Game Code. • California Red-legged Frog Habitat. Fully compensate for impacts on 0.11 acre and 10,366 linear feet of California red-legged frog aquatic breeding habitat, and fully compensate for any loss of breeding habitat in Alameda Creek downstream of the confluence with Calaveras Creek that may result from a potentially increased bullfrog population by improving aquatic breeding habitat through predator control in impaired water bodies in the South Calaveras Mitigation Area (SCMA) within 5 years of completion of construction, and by improving breeding habitat conditions in Alameda Creek from the Alameda Creek Diversion Dam (ACDD) to the Calaveras Creek confluence beginning with the advent of bypass flows; fully compensate for permanent impacts on 2.33 acres and 4,387 linear feet of California red-legged frog aquatic non-breeding and 656 acres of upland habitat within 5 years of completion of construction by restoring, enhancing, and protecting intermittent stream habitat at the South Calaveras and San Antonio Mitigation Areas within 10 years of completion of construction. • California Tiger Salamander Habitat. Fully compensate for impacts on 0.11 acre of California tiger salamander aquatic habitat by improving aquatic habitat through predator control in impaired water bodies in the SCMA within 5 years of completion of construction; fully compensate for permanent impacts on 971.6 acres	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		of upland habitat within 5 years of completion of construction by protecting upland habitat within 1 year of completion of construction. • Alameda Whipsnake Habitat. Fully compensate for impacts on 33 acres of scrub/shrub habitat and 13.7 acres of rock outcrop habitat for the Alameda whipsnake by establishing scrub habitat and protecting rock outcrops at the Sage Canyon Mitigation Area within 5 years of completion of construction; fully compensate for permanent impacts on 606.9 acres of woodland and grassland habitat by protecting grasslands and woodlands adjacent to scrub at all four mitigation areas within 1 year of completion of construction. • Callippe Silverspot Butterfly Habitat. Fully compensate for impacts on 0.57 acres of callippe silverspot butterfly larval habitat by enhancing and protecting grasslands containing the larval host plant (<i>Viola pedunculata</i>) at the SCMA and Sage Canyon Mitigation Area within 5 years of completion of construction. • Foothill Yellow-legged Frog Habitat. Document that project benefits to foothill yellow-legged frog habitat in Alameda Creek from the ACDD to the Calaveras Creek confluence fully compensate for the loss of 9,421 linear feet of habitat in Arroyo Hondo, and fully compensate for any loss of breeding habitat in Alameda Creek downstream of the confluence with Calaveras Creek that may result from a potentially increased bullfrog population within 5 years of the start of bypass flows at the ACDD. • Annual Grasslands. Fully compensate for impacts on 418 acres of annual grassland habitat by establishing native perennial grasslands and enhancing and protecting annual grasslands at all four mitigation areas within 5 years of completion of construction. • Serpentine Grasslands. Fully compensate for impacts on 13.6 acres of serpentine grassland habitat by enhancing and protecting serpentine grasslands at the Goat Rock Mitigation Area within 5 years of completion of construction. 5.4.3b Site Selection The final compensation plan(s) shall include a description of the factors considered during the final mitigation site selection process, including consideration of watershed needs, on-site alternatives, and the practicability of accomplishing ecologically self-sustaining habitats at the mitigation sites.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		5.4.3c Site Protection Instrument The final compensation plan(s) shall include a description of the legal arrangements and instruments, including site ownership, that will be used to ensure the long-term protection of the compensation sites. 5.4.3d Baseline Information The final compensation plan(s) shall include descriptions of the ecological characteristics of the proposed compensation sites, impact sites, and any reference sites. This shall include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a delineation of waters of the state and U.S., a map showing the locations of the impact, mitigation, and reference sites, and other site characteristics appropriate to the types of resources proposed as compensation. 5.4.3e Compensation Ratios The final compensation plan(s) shall specify the compensation ratios for all habitat types addressed in the plan(s) needed to achieve no net loss of habitat areas, functions, and services, and the rationale used to determine these ratios. Factors considered in determining mitigation ratios shall include: • The likelihood of success; • Differences between the habitat functions and services lost and those expected to be provided by the compensation; • Temporal losses of resource functions and services; • The difficulty of restoring or establishing the desired habitat types and functions; and • The distances between the affected habitat and compensation sites. 5.4.3f Mitigation Work Plan The final compensation plan(s) shall include detailed written specifications and work descriptions for the compensation projects, including, but not limited to: the geographic boundaries of the projects; construction methods; timing and sequence; sources of water, including connections to existing waters and uplands; soil properties (e.g., particle size, organic content); methods for establishing the desired plant communities; plans to control invasive plant and animal species; dewatering plans; proposed grading plans, including elevations and slopes of the substrate; soil management; and erosion control	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		measures. For stream habitat compensation projects, the work plan shall also include: planform geometry; channel form (e.g., typical channel cross-sections and longitudinal profiles); stream type (i.e., ephemeral, intermittent, or perennial); location in watershed; watershed size (i.e., drainage area); mean annual precipitation; channel-forming discharge (i.e., design discharge); and riparian area plantings. 5.4.3g Maintenance Plan The final compensation plan(s) shall include a description and schedule of maintenance requirements to ensure the continued viability of the habitats once initial construction is completed. 5.4.3h Success Criteria The final compensation plan(s) shall include ecologically based criteria that will be used to determine whether the compensation projects are achieving their objectives. The success criteria shall be based on attributes that are objective and verifiable. 5.4.3i Monitoring Plan The final compensation plan(s) shall include a description of parameters to be monitored to determine whether the compensation projects are on track to meet performance standards and whether adaptive management is needed. Suitable reference sites may be identified in which case the criteria used to select the reference sites shall be provided. Monitoring may include collaboration with relevant ongoing studies (e.g., Alameda Creek foothill yellow-legged frog and California red-legged frog monitoring by the East Bay Regional Parks District). A schedule for monitoring and reporting on monitoring results must be included. 5.4.3j Long-term Management Plan The final compensation plan(s) shall include a description of how the compensation sites will be managed after the performance standards have been achieved to ensure the long-term sustainability of the resources, including long-term financing mechanisms and the party responsible for long-term management. 5.4.3k Adaptive Management Plan The final compensation plan(s) shall include a management strategy to address unforeseen changes in site conditions or other components of the compensation projects, including the party or parties responsible for implementing the adaptive management	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		measures. The adaptive management plan will guide decisions for revising the final compensation plan(s) and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect mitigation success. Adaptive management actions may include the purchase of mitigation credits from an approved mitigation bank. 5.4.31 Financial Assurances The final compensation plan(s) shall include a description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the compensation projects will be successfully completed in accordance with the performance standards. Also see Vegetation and Wildlife Mitigation Measure 5.4.1.	
4.4.4 Effect of CDRP on Alameda whipsnake.	Construction: S Filling: S Operation: LS	See Vegetation and Wildlife Mitigation Measures 5.4.1 and 5.4.3.	LSM LSM LS
4.4.5 Effect of CDRP on callippe silverspot butterfly.	Construction: S Filling: NI Operation: NI	See Vegetation and Wildlife Mitigation Measure 5.4.3 and Air Quality Mitigation Measures 5.13.1a and 5.13.1b.	LSM NI NI
4.4.6 Effect of CDRP on bald eagle.	Construction: S Filling: LS Operation: LS	See Vegetation and Wildlife Mitigation Measure 5.4.1.	LSM LS LS
4.4.7 Effect of CDRP on foothill yellow-legged frog.	Construction: S Filling: S Operation: S	See Vegetation and Wildlife Mitigation Measures 5.4.1 and 5.4.3 and Water Quality Mitigation Measure 5.7.1.	LSM LSM LSM
4.4.8 Effect of CDRP on Heermann's kangaroo rat.	Construction: NI Filling: NI Operation: NI	No mitigation necessary.	NI NI NI
4.4.9 Effect of CDRP on other special-status species.			
4.4.9a Effect of CDRP on western pond turtle.	Construction: S Filling: LS Operation: LS	See Vegetation and Wildlife Mitigation Measure 5.4.1.	LSM LS LS

Table S.2 (Continued)

	Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.4.9b	Effect of CDRP on nesting raptors.	Construction: S Filling: S Operation: LS	See Vegetation and Wildlife Mitigation Measure 5.4.1.	LSM LSM LS
4.4.9c	Effect of CDRP on upland Species of Special Concern, bats, and migratory birds.	Construction: S Filling: S Operation: LS	See Vegetation and Wildlife Mitigation Measures 5.4.1 and 5.4.3.	LSM LSM LS
4.4.10	Effect of CDRP on special-status plant species.	Construction: S Filling: LS Operation: LS	See Vegetation and Wildlife Mitigation Measure 5.4.1.	LSM LS LS
4.4.11	Effect of CDRP on sensitive vegetation communities.	Construction: S Filling: LS Operation: LS	See Vegetation and Wildlife Mitigation Measure 5.4.3.	LSM LS LS
4.4.12	Effect of CDRP on local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.	Construction: S Filling: NI Operation: NI	See Vegetation and Wildlife Mitigation Measures 5.4.1, 5.4.2, and 5.4.3 and Water Quality Mitigation Measure 5.7.1.	LSM NI NI
4.5 Fisheries and Aquatic Habitat				
4.5.1	Construction-related effects on fish occupying habitat in Calaveras Creek downstream of the existing dam.	S	5.5.1 Native Fish Capture and Relocation Prior to commencement of construction downstream of the existing dam, a qualified biologist shall capture and relocate native fish within the dam construction impact area and downstream approximately 100 feet. All captured native fish species shall be immediately released to a suitable habitat near the project site. The qualified biologist shall place nets with 1/8-inch mesh at the downstream extent to keep fish out of the area during fish removal activities. A small cofferdam shall be constructed at the lower end of the work area, and the work area shall then be dewatered. Fish rescue and relocation shall continue until the area is completely dewatered, or until it is determined that no fishes remain in the dewatering area.	LSM
4.5.2	Construction-related permanent loss of fish habitat in Calaveras Creek downstream of the existing dam.	LS	No mitigation necessary.	LS

Table S.2 (Continued)

	Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.5.3	Effect of project on creating barriers to fish movement/migration upstream in Calaveras and Alameda Creeks.	NI	No mitigation necessary.	NI
4.5.4	Temporary effects on fisheries resources related to increases in sediments and turbidity and to release of and exposure to contaminants.	S	See Water Quality Mitigation Measure 5.7.1.	LSM
4.5.5	Effects on native fish in Alameda Creek from the ACDD downstream to the confluence with Calaveras Creek.	S	5.5.5a Resident Rainbow Trout Monitoring The SFPUC shall develop and implement a Resident Rainbow Trout Monitoring Plan in consultation with CDFG and NMFS. Monitoring results shall be provided to the resource agencies as requested. Monitoring shall occur for a minimum of five years and a maximum of ten years following completion of the CDRP. At the completion of the monitoring period, the SFPUC shall produce a draft comprehensive report describing the methods, data collected, and results used to assess the performance of the minimum streamflow in providing suitable habitat for resident trout spawning and egg incubation. The Resident Rainbow Trout Monitoring Plan may be modified by or combined with any future steelhead monitoring requirements. If monitoring indicates that the bypass flows at the ACDD and flow releases at Calaveras Dam provided as part of the CDRP are adequate to sustain the resident trout population in Alameda Creek downstream of the ACDD, then no additional mitigation action would be required. If monitoring indicates that this measure does not sustain the resident trout fishery in this reach, then the SFPUC shall implement Measure 5.5.5b Resident Rainbow Trout Adaptive Management. 5.5.5b Resident Rainbow Trout Adaptive Management If 10 years of monitoring results for Measure 5.5.5a, Resident Rainbow Trout Monitoring, indicate that the bypass flows at the ACDD and flow releases at Calaveras Dam provided as part of the CDRP do not sustain the resident trout population in Alameda Creek downstream of the ACDD, then the SFPUC shall also implement additional measures as follows: modify the flow release schedules, implement seasonal restrictions on Alameda Creek diversions to Calaveras Reservoir to protect the downstream resident trout fishery during the spawning period (December 1 through April 30), or install and operate a fish passage barrier to "screen" the diversion facility (screening could consist of a behavioral barrier, such as electrical or sound barrier that deters fish, or a physical barrier – such as a screen facility). Modification of the flow	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		release schedules for resident rainbow trout will be consistent with any future flow release schedules for steelhead. SFPUC shall consult with the appropriate resource agencies, including CDFG, to first review the monitoring results for Measure 5.5.5a and determine the need for any further mitigation actions. If needed, SFPUC will either (a) consult with the appropriate resource agencies to develop additional flow releases, and/or seasonal restrictions on diversions (this could involve modifying the flow release schedules, establishing a set annual time period for diversion restrictions, or annual monitoring of fishery conditions that would then trigger implementation of diversion restrictions); or (b) implement a fish passage barrier if determined to be feasible. During the 10-year monitoring and evaluation period for Measure 5.5.5a, the SFPUC will evaluate the feasibility of installing and operating a fish passage barrier. The feasibility study will include an engineering evaluation of the existing site and diversion structure, access for construction and power supplies to the site, the application of various alternative designs, and identification of a preferred design if determined to be feasible. If it is determined that a fish passage barrier is needed to protect resident trout at the diversion structure then engineering design will be completed and be sufficiently detailed to allow permitting and completion of construction within a period of 24 months after the date that the additional mitigation is determined to be required.	
4.5.6 Effects on native fish in Calaveras Creek below Calaveras Dam and in Alameda Creek downstream of the confluence with Calaveras Creek in the primary study area.	LS	No mitigation necessary.	LS
4.5.7 Effects of project operations on fish habitat in Calaveras Reservoir and in streams upstream of the replacement dam.	B	No mitigation necessary.	B
4.5.8 Effects of project operations on native fish in Alameda Creek in the extended study area.	LS	No mitigation necessary.	LS
4.5.9 Potential for conflict with local plans protecting fisheries and aquatic habitat.	S	See Fisheries and Aquatic Habitat Mitigation Measures 5.5.1, 5.5.5a, and 5.5.5b and Water Quality Mitigation Measure 5.7.1.	LSM

Table S.2 (Continued)

Impact		Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.6 Hydrology				
4.6.1	Construction of the replacement dam would temporarily change flow rates in Calaveras and Alameda Creeks downstream of Calaveras Dam.	LS	No mitigation necessary.	LS
4.6.2	Construction of the replacement dam would temporarily increase downstream flooding risk.	LS	No mitigation necessary.	LS
4.6.3	Construction-related activities could affect local groundwater supplies in the vicinity of the dam.	LS	No mitigation necessary.	LS
4.6.4	Operational effects on flows in Calaveras Creek downstream of Calaveras Dam.	LS	No mitigation necessary.	LS
4.6.5	Operational effects on flow in Alameda Creek downstream of the ACDD to the Calaveras Creek confluence.	LS	No mitigation necessary.	LS
4.6.6	Operational effects on flow in Alameda Creek, Calaveras Creek confluence to Arroyo de la Laguna confluence.	LS	No mitigation necessary.	LS
4.6.7	Operational effects on flow in Alameda Creek downstream of the Arroyo de la Laguna confluence.	LS	No mitigation necessary.	LS
4.6.8	Downstream flooding and hazard in the event of dam failure.	LS	No mitigation necessary.	LS
4.6.9	Effects on channel formation and sediment transport along Calaveras Creek.	LS	No mitigation necessary.	LS
4.6.10	Effects on channel formation and sediment transport along Alameda Creek downstream of the ACDD to the Calaveras Creek confluence.	LS	No mitigation necessary.	LS
4.6.11	Effects on channel formation and sediment transport along Alameda Creek downstream of the Calaveras Creek confluence.	LS	No mitigation necessary.	LS

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.6.12 Changes in groundwater levels, flows, quality, and supplies.	LS	No mitigation necessary.	LS
4.7 Water Quality			
4.7.1 Impact on water bodies as a result of soil erosion and sediment discharge during construction.	S	5.7.1 Storm Water Pollution Prevention Plan Consistent with the requirements of the State Water Resources Control Board General Permit for Storm Water Discharges Associated with Construction Activity, the SFPUC shall undertake the proposed project in accordance with a project-specific Storm Water Pollution Prevention Plan (SWPPP). The San Francisco Bay Regional Water Quality Control Board (RWQCB), the primary agency responsible for protecting water quality within the project area, is responsible for reviewing and ensuring compliance with the SWPPP. This review is based on the general permit issued by the State Water Resources Control Board. The recommended Best Management Practices (BMPs), subject to review and approval by the RWQCB, include the measures listed below. However, the measures themselves may be altered, supplemented, or deleted during the RWQCB's review process, since the RWQCB has final authority over the terms of the SWPPP. Scheduling • Implement BMPs year-round during wet and dry weather. • Include a wet-weather contingency plan stating which BMPs will be used. • Include a schedule for BMP implementation that accounts for any time lag between initial application of certain BMPs (such as stabilizers, hydroseeding) and effective stabilization. • Do not allow placement of fill or excavation in Borrow Area E from mid-December to mid-March, unless conditions are suitable (i.e., dry). • Schedule and sequence construction activities to minimize the areal extent and duration of site disturbance at any time. Preservation of Existing Vegetation • Provide work exclusion zones outside of work areas to protect vegetation and to minimize the potential for removing or injuring trees, roots, vines, shrubs, and grasses.	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Avoid disturbance of riparian and wetland vegetation by installing flagging and temporary fencing. • Document the amount, type, and quality of removed wetland and riparian vegetation and its condition during the maintenance period and at the time of replanting. • At the disturbed riparian and wetland sites, cover cleared areas with mulches or protective mats, install silt fences near remaining riparian areas and streams to control erosion and trap sediment, and reseed cleared areas with native vegetation. <u>Erosion and Sediment Controls</u> • Use berms, ditches, or other structures to divert natural surface runoff around construction areas. • Install fiber rolls, straw-wattles, coir logs, silt fences, or other effective devices along drainage channels to prevent soils from moving into creeks. • Install check dams, level spreaders, water bars, rock outlet protection for culverts, grade stabilization structures, or other devices to slow the velocity of stormwater runoff and reduce erosion potential. • Install sediment control devices during construction, including but not limited to silt fences, check dams, ponds, and basins. • Locate sediment traps to obtain the maximum storage benefit from the terrain, and to facilitate cleanout and disposal of the trapped sediment. • Dispose of sediment removed from traps, ditches, and culverts in the spoils disposal sites. • Maintain access roads throughout the construction period. • Stabilize temporary roads and construction entrances to minimize erosion and prevent mud and dirt from being tracked off site. • Locate stockpiles at least 50 feet from creeks, drainage channels, and drainage swales, whenever possible. • Install fiber rolls, straw-wattles or silt fencing between stockpiles and creeks, drainage channels, and drainage swales. • Use silt fences or silt curtains when fill placement or excavation is adjacent to or in Calaveras Reservoir.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		<u>Slope Protection</u> • After excavating any open-cut slopes, install slope protection measures such as fiber rolls, drainage ditches, or erosion control fabrics to minimize the potential for concentrated surface runoff to cause erosion. (Not applicable to work at finished rock faces.) • Stabilize vertical to nearly-vertical rock faces that are unable to support vegetation by cleaning the slopes of loose debris and benching them for stability. <u>Temporary Stream Crossings</u> • Construct temporary stream crossings using a temporary bridge with gravel approach ramps or temporary culverts backfilled with clean gravel/cobbles and topped with a gravel road base. • Do not place earth and rockfill material in stream channels. • Upon completion of the project, remove or stabilize temporary stream crossings with banks graded to a stable angle. <u>Wind Erosion Control</u> • Implement wind erosion or dust control procedures consisting of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance generated by construction activities. The contractor may choose to cover small stockpiles or areas as an alternative to applying water or other dust palliatives. • Reduce wind speeds at the surface of soil stockpiles by erecting a windscreen or by changing the pile orientation or shape if covering piles is not practicable (i.e., when access to the pile is necessary). • If runoff water could discharge to receiving waters, require that dust palliatives or tackifiers be ANSI/NSF 60–certified (Drinking Water Treatment Chemicals – Health Effects). • Control water application rates to prevent runoff and ponding. Repair leaks from water trucks and equipment immediately.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		<u>Treatment Controls</u> • In order to meet the Basin Plan water quality objectives, install turbidity barriers and collect and treat drainage and runoff water from any part of the work area that has become turbid with eroded soil, silt, or clay to reduce turbidity prior to discharge to receiving waters. • Use only certified ANSI/NSF 60 (Drinking Water Treatment Chemicals – Health Effects) coagulants or flocculants for treatment unless otherwise approved by the RWQCB. Review information on the effects of the coagulant or flocculant on aquatic life prior to selection. • For naturally occurring asbestos (NOA)-containing areas, treatment may include coagulation/flocculation (if necessary), sedimentation, and filtration. For non-NOA/metals-containing areas, treatment may include only sedimentation. • Prepare a dewatering plan prior to excavation. • Impound dewatering discharges in sediment retention basins or other holding facilities to settle the solids and provide treatment prior to discharge to receiving waters as necessary to meet Basin Plan water quality objectives. • Locate sediment retention basins a minimum of 50 feet from surface waters, creeks, drainage channels, and drainage swales, whenever possible. • An off-site project may be required if an unusual storm event occurs and water discharges have not settled to avoid significant sedimentation from reaching Alameda Creek or its tributaries. Off-site erosion control projects may include gully repairs, stream bank stabilization, slide repairs, or other actions acceptable to the RWQCB. The RWQCB may determine through the permitting process that an off-site erosion control project within the Alameda Watershed could be required to offset impacts on water quality. The RWQCB will determine appropriate drainage and runoff treatment controls as part of the SWPPP review and 401 Water Quality Certification permitting process. <u>Hazardous Materials</u> • Keep hazardous materials and other wastes at least 100 feet from wetlands, creeks, drainage channels, and drainage swales, whenever possible.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Store hazardous materials in areas protected from rain, and provide secondary containment to prevent leaks or spills from affecting water quality. • Implement the following hazardous materials handling, storage, and spill response practices to reduce the possibility of adverse impacts from use or accidental spills or releases of contaminants: - Develop and implement strict on-site handling rules to keep construction and maintenance materials out of drainages and waterways. - Conduct all refueling and servicing of equipment with absorbent material or drip pans underneath to contain spilled fuel. Collect any fluid drained from machinery during servicing in leak-proof containers and deliver to an appropriate disposal or recycling facility. - Maintain controlled construction staging, site entrance, concrete washout, and fueling areas a minimum of 100 feet from stream channels or wetlands whenever possible to minimize accidental spills and runoff of contaminants in stormwater. - Prevent raw cement, concrete or concrete washings; asphalt, paint, or other coating material; oil or other petroleum products; or any other substances that could be hazardous to aquatic life from contaminating the soil or entering watercourses. - Maintain spill cleanup equipment in proper working condition. Have spill kits and cleanup materials available at all locations of drilling and pile driving, as applicable. Clean up all spills immediately according to the spill prevention, control, and countermeasure plan, and immediately notify the CDFG and the RWQCB of any spills to waterways and cleanup procedures. - Properly dispose of used oils, fluids, lubricants, and spill cleanup materials. - Keep vehicles and equipment clean; do not allow excessive build-up of oil and grease. - Inspect on-site vehicles and equipment daily at start-up for leaks, and repair any leaks immediately.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		Hazardous Materials Handling Near Water (includes measures for barges, if selected) - In the SWPPP, specify appropriate construction and material transportation and stockpiling practices to reduce the potential for discharging sediment and other construction materials into Calaveras Reservoir or for increasing turbidity related to barging and the construction of temporary docking facilities (if used): - When not in use, store pile-driving equipment away from concentrated flows of stormwater, drainage courses, and inlets. Protect hammers and other hydraulic attachments from runoff and runoff by placing them on plywood and covering them with plastic or a comparable material prior to the onset of rain. - Place drip pans under all vehicles and equipment on docks, barges, or other structures over water bodies when the vehicle or equipment is expected to be idle for more than 1 hour. - Identify types of spill control measures to be employed, including the storage of materials and equipment. Ensure that staff is trained regarding the use of the materials, deployment and access of control measures, and reporting measures. - Use suction dredging, if feasible, to construct barge access channels. - Install a turbidity barrier around the work area during lane dredging and during the installation of jetties or docks and anchors. - Place dredged material directly into haul trucks that will dispose of the materials. Use lined haul trucks to prevent leaks or spills of sediment-laden water from dredged material. Do not allow temporary storage or dewatering of dredged spoils on site. - Test dredged materials during construction, and dispose of contaminated materials only at approved disposal facilities. - Establish and enforce barge and tugboat speeds and no-wake zones to decrease erosional energy and turbidity. - Maintain equipment that is stored or used in streambeds or on docks, barges, or other structures over water bodies to prevent leaks of oil, grease, fuel, coolants, and hydraulic fluids. - Secure all materials on the barge to prevent discharges to receiving waters via wind. - Install steel decking over the barge pontoons to minimize the potential for clay materials to fall into the reservoir during transport and loading.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		- Use sideboards to confine the clay materials on the barge and prevent the material from falling off the edge of the barge. - Perform loading and unloading of the barges within designated areas that are isolated from the rest of the reservoir by turbidity barriers. <u>Solid Waste Management</u> • Specify solid waste management practices to prevent the discharge of pollutants to stormwater from solid waste. • Select designated waste collection areas on site. • Provide an adequate number of waste containers with lids or covers that can be placed over the container to keep rain out or to prevent the loss of wastes when it is windy. • Arrange for regular waste collection before containers overflow, especially during rainy and windy conditions. <u>Equipment Maintenance</u> • Fuel, maintain, and park vehicles and equipment at least 100 feet from wetlands, creek channels, and drainage swales unless adequate measures have been taken to assure that petroleum products, hydraulic fluids, or other waste products are not discharged to wetlands, creeks, or storm drainage facilities. If dam foundation excavation operations, drilling and grouting operations, or barging require fueling or emergency maintenance activities near or on water bodies, the following measures will be taken to ensure that petroleum products, hydraulic fluids, or other waste products are not discharged to surface water or groundwater: - Check and maintain any equipment or vehicle driven and/or operated adjacent to a wetland or creek channel daily to prevent leaks. - If it is necessary for maintenance purposes to drain and replace fluids on site, collect the spent fluids using drip pans and drip cloths, store these items in separate labeled containers, and disposed of them properly (recycled when possible). - Provide secondary containment for fueling and maintenance to prevent leaks and spills from affecting water quality. <u>Equipment Washing</u> • Do not discharge water from equipment washing into drainages, or allow it to percolate into the ground.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		- Wash equipment off site, except when on-site washing is required to reduce hazards associated with NOA. If equipment must be washed on site, then only water may be used. Do not use soaps, solvents, degreasers, steam cleaning, or other similar products or methods unless all of the discharge is collected for appropriate off-site disposal. - Wash equipment used in NOA-containing areas with water and brushes or a wheel wash system prior to entering non-NOA-containing areas, as required in the asbestos dust mitigation plan. Wheel wash systems will use water without solvents. - After water from equipment or wheel washing has been treated with an oil/water separator and for turbidity/sediment removal, allow the water to be used for dust control or to percolate into the ground away from water bodies. <u>Material and Equipment over Water</u> - Use, store, and dispose of materials and equipment on barges, boats, temporary construction pads, or similar locations using appropriate procedures that minimize or eliminate the discharge of potential pollutants to a watercourse. <u>Material Delivery and Storage</u> - Prevent, reduce, or eliminate the discharge of pollutants from material delivery and storage to the stormwater system or watercourses by minimizing the storage of hazardous materials on site, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors. <u>Post-Construction Site Restoration and Stabilization</u> - Upon project completion, return the project site to its general condition before construction, including re-grading the site and re-vegetating disturbed areas. - Prepare and implement a detailed re-vegetation plan to ensure that appropriate plant cover becomes established in disturbed areas. This plan will identify measures to establish vegetation by planting, seeding, and irrigation, if necessary. The restoration plan will specify slope inclination and permanent drainage swales and berms to mitigate erosion of the disposal fills. - Grade the final borrow area and disposal area slopes as flat as possible and bench them to control runoff. Upon completion of the project, remove all construction debris and associated materials from the work site.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		- Inspect haul roads and staging areas for visible staining from spills or leaks of oil, grease, fuel, or other contaminants and remove any contaminated soils from inundation areas prior to refilling the reservoir. <u>Inspection and Maintenance</u> - Inspect all disturbed sites in the first week of October and no later than October 15 to document that all erosion and sediment control BMPs have been installed properly according to the BMP requirements. - During the rainy season (October 15 through April 15), inspect all erosion and sediment control measures at least biweekly on sites with a low erosion hazard and weekly on slopes that are 15 percent or greater and in areas with highly erosive soils. - After the first storm of record, inspect all erosion and sediment control measures daily, during and after each storm event. - Repair breaches in erosion and sediment control devices at the close of each day and whenever rain is forecasted. - Repair or replace erosion control devices after each rainstorm. - Inspect sediment retention basins every working day. - Stockpile at the site sufficient devices and materials (e.g., silt fencing, fiber rolls, straw bales, erosion mats, sand bags, gravel, plastic sheeting, soil tackifiers, flocculants, baker tanks, and pumps) to enable immediate repair or replacement of failed BMPs. - Immediately correct and report any failure, deficient performance, or improper installation of any control measures. - Maintain access roads throughout the construction period. - Regularly inspect all haul road surfaces to ensure that a gravel surface cover is maintained in good condition throughout the construction period. Immediately repair ruts, worn water bars and washed-out areas if identified. <u>Monitoring and Reporting</u> - For real-time information, use turbidity measurements during construction as a surrogate for asbestos measurements.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Monitor turbidity downstream of the project to assess the effectiveness of control measures and protect water quality. Specify site-specific monitoring methods in the SWPPP. • Treat all elevated levels of turbidity, asbestos, and metals to bring them within the established water quality standards in force at the time of occurrence. • Notify the RWQCB, Alameda County Water District, Alameda County Environmental Health Services Department, and East Bay Regional Park District in the event of elevated turbidity or a spill or release of contaminants, NOA, or metals to any waterways in the Alameda Creek system. See also Air Quality Mitigation Measure 5.13.1a, below.	
4.7.2 Impact on water bodies as a result of a hazardous materials release, NOA or metals release, or solid waste discharge during construction.	S	5.7.2 Drilling Fluids If drilling muds/fluids are used for drilling operations, the SFPUC will ensure that drilling fluids contain only water and bentonite or similar inert substances (i.e., contain no environmental pollutants) and that any drilling fluids used are properly contained. If on-site containment and dewatering methods are used, the SFPUC and its contractors will ensure the contained materials are not susceptible to runoff during storms. Barriers (e.g., silt fence or berm) will be installed to prevent discharge of drilling fluids to receiving waters. Drilling fluids will be dewatered on site if approved by regulatory permitting agencies and/or properly disposed of off site. The SFPUC or its contractor will prepare and implement a Drilling Contingency Plan to manage the inadvertent release, or “frac-out,” of drilling fluids. If the contractor prepares the plan, it will be subject to approval by the SFPUC before drilling work can begin. The Drilling Contingency Plan will include measures to minimize the potential for a frac-out (e.g., pre-planning of the drilling profile based on ground conditions so that the potential for a release of fluids is minimized); provide for the timely detection of frac-outs; and ensure an organized, timely, and “minimum-impact” response in the event of a frac-out and release of drilling fluid. Specifically, the Drilling Contingency Plan will require, at a minimum, the following measures and content:	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• The contractor will provide a monitor on site during drilling operations to look for observable inadvertent releases or frac-out conditions or lowered pressure readings on drilling equipment that may indicate a potential frac-out. • If the contractor and/or drill-rig operator suspects a frac-out (e.g., notices a loss of circulation of drilling fluid and cuttings do not show a large quantity of gravel) or drilling fluid is observed at the surface, the contractor will implement measures to stop the frac-out, such as reducing the drilling pressure or thickening the drilling fluid (e.g., by using less water). If measures to stop frac-out are not successful, all drilling work will stop, including the recycling of drilling fluid, until the location and extent of the frac-out can be determined and remedied. • If the drilling fluid does not surface, no other actions will be taken. • If the drilling fluid surfaces, the affected area will be surrounded with a barrier (e.g., berm and/or silt fence) to prevent discharge of the fluid to surface waters. If the drilling fluid is released into surface waters and there is a visible plume, a sediment boom or curtain will be installed downstream of the frac-out to attempt to capture the released drilling fluid. The drilling fluid will then be removed using the minimum amount of equipment needed (e.g., manually or by suction hose using a vacuum truck) in order to minimize impacts on the surface area where the frac-out occurred. • If the response measures described above contain the frac-out, drilling may resume. • The SFPUC will ensure that the Drilling Contingency Plan also includes procedures for notification of and reporting of frac-outs to applicable regulatory agencies (i.e., Regional Water Quality Control Board, Alameda County Water District). See also Water Quality Mitigation Measure 5.7.1 and Hazards and Hazardous Materials Mitigation Measure 5.9.2a.	
4.7.3 Impact on water bodies as a result of erosion and sediment discharge or a hazardous materials release associated with construction of barge docking facilities and during barging operation.	S	See Water Quality Mitigation Measure 5.7.1, above.	LSM
4.7.4 Impact on reservoir water quality during and following inundation due to contact with borrow materials containing NOA, metals, or contaminants.	S	See Water Quality Mitigation Measure 5.7.1, Geology, Soils, and Seismicity Mitigation Measure 5.8.3, and Hazards and Hazardous Materials Mitigation Measure 5.9.2a.	LSM

Table S.2 (Continued)

	Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.7.5	Changes in water quality parameters in Calaveras Reservoir during future operation and restoration of pre-DSOD-restricted reservoir conditions.	B	No mitigation necessary.	B
4.7.6	Changes in water quality parameters in Calaveras and Alameda Creeks during future operation.	LS	No mitigation necessary.	LS
4.7.7	Changes in groundwater quality related to construction and operations.	S	See Water Quality Mitigation Measure 5.7.1, above.	LSM
4.8 Geology, Soils, and Seismicity				
4.8.1	Landslide activation as a result of construction activities, resulting in structural damage and injuries.	LS	No mitigation necessary.	LS
4.8.2	Impacts of excavation, placement of fill, and other construction activities on soils with severe erosion and slope instability hazards.	S	See Water Quality Mitigation Measure 5.7.1, above.	LSM
4.8.3	Impacts on slopes at the disposal sites due to fill settlement, slippage, and failure under seismic loading.	S	5.8.3 Geotechnical Evaluation for Disposal Site Stabilization A geotechnical evaluation shall be completed for reserve Disposal Site 5 if the fill placement creates final slopes greater than 20 feet high. The analysis shall address static stability, hazards from fault offset, drainage, erosion control, and grading requirements. The investigation and analysis shall be coordinated with the civil engineering design of the disposal site and shall be completed under the direction and oversight of a California-licensed Geotechnical Engineer. The geotechnical investigation report shall be reviewed and approved by SFPUC Engineering Management Bureau. All measures specified for design and construction of the fills shall be implemented by the construction contractor.	LSM
4.8.4	Seismic hazards at the replacement dam.	LS	No mitigation necessary.	LS
4.8.5	Hazards of seismically induced ground failure, including liquefaction, lateral spreading, and settlement at disposal fill sites.	S	See Geology, Soils, and Seismicity Mitigation Measure 5.8.3, above.	LSM

Table S.2 (Continued)

Impact		Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.8.6	Impacts on project structures and buried utilities from expansive or corrosive soils.	LS	No mitigation necessary	LS
4.8.7	Induced seismic activity from reservoir refilling.	LS	No mitigation necessary	LS
4.8.8	Alteration of the existing topography and geologic features of the site.	LS	No mitigation necessary	LS
4.9 Hazards and Hazardous Materials				
4.9.1	Release of hazardous materials in soil and groundwater during construction.	S	5.9.1 Groundwater at Former Calaveras Test Site The SFPUC shall notify the San Francisco Bay RWQCB of planned excavation activities in the vicinity of the former Calaveras Test Site and shall implement the monitoring requirements specified by the RWQCB to demonstrate that excavation activities in Borrow Area E do not adversely affect the groundwater plume at the former Calaveras Test Site and to detect the presence of previously unidentified soil or groundwater contamination, if encountered. The monitoring requirements and potential response actions, should monitoring identify effects on the groundwater plume or previously unidentified contamination, shall be specified in a contingency plan prepared by the construction contractor for review by the SFPUC. The contingency plan shall identify potential response actions, such as segregation, testing, and treatment of affected soil and groundwater.	LSM
4.9.2	Release of airborne NOA and naturally occurring metals from excavation, hauling, blasting, tunneling, placement, and on-site disposal of Franciscan Complex serpentinite or mélange.	S	5.9.2a Dust Mitigation Plan and Comprehensive Air Monitoring Plan The SFPUC shall prepare an asbestos Dust Mitigation Plan for approval by Bay Area Air Quality Management District (BAAQMD) as required in Section 93105 of Title 17 of the California Code of Regulations, "Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations." The DMP shall specify site-specific measures that would be taken to minimize emissions of NOA and metals-containing dust and to ensure that asbestos and metals (including chromium, nickel, arsenic, copper, and cobalt) concentrations do not exceed regulatory-approved risk-based trigger levels at the air monitoring perimeter of work limits during construction. The SFPUC shall include all applicable dust mitigation measures set forth in the Dust Mitigation Plan in the construction contract for the project. The SFPUC would also engage a third party consultant that would provide review and monitoring of the construction contractor's air monitoring activities, other NOA-related construction contractor worker protection measures, and the construction contractor's	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		NOA soil and rock evaluations for compliance with contract requirements. The consultant would also conduct the comprehensive air monitoring required by Comprehensive Air Monitoring Plan (described below). The third party consultant would be qualified in ambient air monitoring under the supervision of a Certified Industrial Hygienist who is also a California Certified Asbestos Consultant. Examples of dust control measures that may be implemented include the measures identified in the Asbestos Airborne Toxics Control Measure (ATCM), as well as project-specific measures to be included in the Dust Mitigation Plan. As provided for in the Asbestos ATCM, alternative measures that provide an equivalent level of dust control may be included in the Dust Mitigation Plan subject to BAAQMD authorization. The Asbestos ATCM includes the following dust control measures for construction activities in NOA containing areas: • Restriction of vehicle speeds on on-site unpaved roads, staging areas, and parking lots to 15 miles per hour; as well as wetting, use of a chemical dust suppressant, or use of a gravel cover containing less than 0.25 percent asbestos or other effective measures in these areas to control dust generation; • Wetting of work surfaces prior to and during construction activities and suspension of grading operations when wind speeds are high enough to result in visible dust emissions crossing the air monitoring perimeter of work limits; • Wetting or use of a cover to control dust from active storage piles; • Wetting, use of a chemical dust suppressant, use of a cover (such as a tarp or vegetative cover), establishment of a surface crusting, use of wind barriers or other effective measures to control dust from inactive storage piles and inactive work areas; • Cleaning of all visible track-out on paved public roads at the end of the work day or at least once per day; • Implementation of track-out prevention measures such as a gravel pad, wheel wash system, use of a paved approach, or other equally effective measures to prevent and control track-out to a public road; • Loading of trucks for off-site transport of NOA-containing materials such that no spillage could occur, as well as wetting the load and either covering it with a tarp or loading the truck such that material does not touch the front, back, or sides of the	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		cargo compartment at any point less than 6 inches from the top and that no point in the load extends above the top of the cargo compartment; and • Post-construction stabilization of disturbed areas with vegetative cover, placement of at least 3 inches of non-asbestos containing material, paving, or any other measure deemed sufficient to prevent wind speeds of 10 miles per hour or greater from causing visible dust emissions. The Dust Mitigation Plan may also include additional project-specific dust control actions for general construction activities, drilling, blasting, rock processing, tunneling, and dam foundation cleaning activities to prevent NOA and metals from migrating beyond the project site boundaries. These actions include: • Washing of equipment used in NOA-disturbing activities after use and prior to removing it from the site; • Sweeping all paved access roads, parking areas, and staging areas daily; • Reducing wind speeds to soil surfaces (by using a wind screen or changing the shape or orientation of the stockpile) to control dust from active storage piles; • Drilling with water in NOA-containing areas; • Restricting blasting activities in areas of NOA and metals to Monday through Friday; • Wetting blast areas as feasible, before, during, and after the blast; • Using blasting blankets as feasible; • Continuous misting or using an equivalent water application technique during the cleaning of the dam foundation and processing of earth and rockfill materials for the new embankment where NOA- and metals-containing rock is present; • Wetting the adit and shaft work surfaces and materials when tunneling in NOA and metals-containing rock, as well as materials derived from these activities; • Prohibiting the use of compressed air for drilling and foundation cleaning and the use of jack hammers for any activities disturbing NOA-containing rocks unless measures are implemented to capture or control airborne dust generated by the process;	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Applying water whenever NOA-containing materials are being removed from the tunnel or adits by mechanical processes such as shovels, excavator buckets, and hydraulic breakers; and/or • Using a treatment system such as a baghouse or HEPA-type filtering device to remove NOA-containing dust from the tunnel exhaust air. The measures in the Dust Mitigation Plan may be altered, supplemented, or replaced during the BAAQMD's review process, since the BAAQMD has final authority over the terms of the Dust Mitigation Plan. The SFPUC shall prepare a Comprehensive Air Monitoring Plan that would describe monitoring that would be conducted to demonstrate compliance with the Asbestos ATCM. The plan would specify two types of monitoring: 1) air monitoring to be conducted at the air monitoring perimeter; and 2) construction activity area monitoring of specific cells of construction activity within the work limits to provide an added level of analysis and control of dust generation during construction. Close monitoring of construction activity cells will provide information to demonstrate whether the generation of dust is being effectively controlled at the source, before it reaches the work limits, providing valuable information regarding the contractor's dust control measures in each cell while monitoring at the perimeter of the work limits would be used to demonstrate compliance with the Asbestos ATCM. The Comprehensive Air Monitoring Plan would specify the location(s) and frequency of perimeter monitoring, and risk-based trigger levels of asbestos and metals (including chromium, nickel, arsenic, copper, and cobalt) that would be protective of off-site receptors (e.g., recreational users of Calaveras Road and/or nearby trails in the Sunol Wilderness area, as well as workers stationed in the Sunol Wilderness), and corrective actions to be taken should the acceptable level of asbestos or metals be exceeded at any monitoring location. Should trigger levels be exceeded at a perimeter monitoring location, the SFPUC would notify Alameda County, East Bay Regional Parks District, and other applicable entities to coordinate activities that may include closure of the affected road or trail, investigate the cause of the exceedance, and implement corrective actions such as implementation of enhanced dust suppression techniques. Should corrective action fail to bring asbestos or metals concentrations to within acceptable limits, the Comprehensive Air Monitoring Plan would require the contractor to modify or temporarily halt construction activities in areas generating excessive dust until dust	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		generation could be maintained within acceptable levels. Affected roads and trails would not be reopened until monitoring indicated that asbestos and metals concentrations are within acceptable limits. Should trigger levels be exceeded in the tunnel emissions, the SFPUC would investigate the cause of the exceedance, and implement corrective actions such as implementation of enhanced dust suppression techniques or additional emission controls. Should corrective action fail to bring asbestos concentrations to within acceptable limits, the Comprehensive Air Monitoring Plan would require the contractor to reduce or stop tunneling in areas generating excessive dust until dust generation could be maintained within acceptable levels. Both the Dust Mitigation Plan and Comprehensive Air Monitoring Plan would be subject to review and approval by the BAAQMD prior to the start of construction.	
		5.9.2b Construction Worker Protection The construction contractor shall implement the asbestos monitoring provisions specified in California Code of Regulations Title 8, Section 1529 (8 CCR 1529), Construction Safety Orders, Asbestos, regulated by the California Division of Occupational Safety and Health (Cal/OSHA), and shall include those provisions in accord with Cal/OSHA for the CDRP to provide additional worker protection measures. These additional measures would be included as additional contract requirements in the construction contract and would be subject to review and monitoring of the SFPUC's third party consultant identified under Mitigation Measure 5.9.2a. Additional measures include, but are not limited to, the following items: • The construction contractor shall provide a Certified Industrial Hygienist who is also a Certified Asbestos Consultant who would be responsible for all aspects of design and implementation of its Personal Air Monitoring program. Contractor personnel will also be Certified Asbestos Consultants or Site Surveillance Technicians under the supervision of a Certified Asbestos Consultant. The construction contractor will implement focused site-specific training under Certified Industrial Hygienist supervision. • The construction contractor shall provide a California Professional Geologist who oversees all determinations of lithological changes during construction.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• The construction contractor shall perform extended initial exposure assessments in a manner that would evaluate both work activities and area specific lithological effects on a regular and frequent basis, including of evaluation of potential exposure on adjacent work areas. The results of these evaluations will be immediately provided to the City's third party consultant. • During construction, workers will be required to implement additional engineering controls and don personal protective equipment for worker respiratory protection based on the results of the extended initial exposure assessments. The trigger level for implementing these additional measures would be set at 10 percent of the Cal/OSHA permissible exposure limit as feasible based on actual field conditions and sample loading. The laboratory analytical method shall be phase contrast microscopy as verified by transmission electron microscopy by NIOSH 7402. • The contractor shall be responsible to inform workers when to don respirators based on air quality monitoring data collected by the contractor. In addition, the contractor shall be required to provide the SFPUC's third party consultant with the same air quality monitoring data. The third party consultant will notify the SFPUC immediately when their review of the contractor's data indicates that the contractor employees should don respirators in any given area of the project, and when their review of the contractor's data indicates that the contractor should reinitiate exposure assessment activities. • The construction contractor shall provide for decontamination (showers, changing areas, disposal of personal protective equipment) for all personnel who have potential for exposure to NOA in excess of 10 percent of the permissible exposure limit prior to leaving the work place in accordance with a Decontamination and Hygiene Facilities Plan reviewed by the City's third party consultant. The plan would specify requirements for decontamination stations, and would also address truck washing, provide for HEPA vacuuming stations, and provide for interim decontamination stations that are easily accessible to personnel to provide worker protective clothing and equipment during work shifts. • Signs would be posted at the entrances to work areas where activities that disturb NOA would occur and along the road to indicate where NOA-containing materials are known to be present or handled.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		5.9.2c Watershed Keeper's Residence The SFPUC shall require the construction contractor to protect the watershed keeper's residence from NOA and metals-laden dust through the use of barriers or equivalent containment throughout the construction period. The acceptable residual level of asbestos and naturally occurring metals in the residence shall be specified in the Comprehensive Air Monitoring Plan prepared in accordance with Mitigation Measure 5.9.2a, and the SFPUC shall conduct clearance sampling to demonstrate compliance with these standards, and clean the residence to the specified standard if standards are not met upon first sampling. 5.9.2d Excavation Materials Management Plan To assist in the management and placement of the surplus rock and soil, the SFPUC shall prepare an Excavated Materials Management Plan for the approval of the RWQCB specifying how excavated rock will be properly classified and managed during construction. The contractor shall be required to segregate materials derived from the Franciscan Complex serpentinite and mélange from other materials for separate hauling, stockpiling and final disposition in the on-site disposal areas.	
4.9.3 Potential for an explosion due to gassy conditions during excavation and tunneling.	LS	No mitigation necessary.	LS
4.9.4 Increased risk of fires during construction in an area of high fire danger.	LS	No mitigation necessary.	LS
4.9.5 Release of hazardous building materials from demolition of existing structures.	S	5.9.5 Hazardous Materials in Structures to Be Demolished Any electrical equipment containing polychlorinated biphenyls (PCBs), fluorescent lights containing mercury vapors or fluorescent light ballasts containing PCBs or Bis(2-ethylhexyl)phthalate (DEHP) in any of the structures to be demolished shall be removed and disposed of properly.	LSM
4.9.6 Release of fuel and other hazardous materials to the environment, including Calaveras Reservoir, during construction.	S	See Water Quality Mitigation Measure 5.7.1, above.	LSM
4.9.7 Fire and safety hazards from use of explosives during construction.	LS	No mitigation necessary.	LS

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.9.8 Effect of raising the reservoir level following construction on groundwater plume migration or natural attenuation of trichloroethene in the groundwater at the Calaveras Test Site or water quality in Calaveras Reservoir.	LS	No mitigation necessary.	LS
4.10 Cultural Resources			
4.10.1 Impact of construction activities on known archaeological resources.	S	5.10.1 Archaeological Evaluation and Monitoring, and Treatment of Human Remains All archaeological documentation required by this mitigation measure shall be consistent with the format and protocols of the San Francisco Planning Department Major Environmental Analysis Division (MEA) Water System Improvement Program (WSIP) Archaeological Guidance, and shall be reviewed and approved by the MEA Archaeologist or Designee. For those projects that require a federal permit and compliance with the National Historic Preservation Act (NHPA), Section 106, the Environmental Review Officer (ERO) will review the State Historic Preservation Officer (SHPO) approved requirements in the permit conditions and consider protective approaches that limit undue duplication of efforts. Based on the findings of the project's Historic Context and Archaeological Survey Report (HCASR) or equivalent analysis in an ASR and Historic Resources Inventory and Evaluation Report (HRIR) and the determination of the MEA Archaeologist or Designee, the SFPUC shall retain the services of a qualified archaeologist (i.e., an archaeologist who meets the professional qualifications standards of the Secretary of the Interior) to undertake the archaeological investigations described below. Archaeological Monitoring Plan The archaeologist shall prepare an Archaeological Monitoring Plan (AMP) consistent with the protocols of the MEA WSIP Archaeological Guidance. The purpose of the AMP will be to ensure that important, previously unrecorded archaeological resources that are discovered during construction are identified, evaluated, and treated appropriately. The AMP will implement Archaeological Measure 5.10.2, below. Archaeological Evaluation Plan The archaeologist shall prepare an Archaeological Evaluation Plan (AEP) consistent with the protocols of the MEA WSIP Archaeological Guidance. The AEP will create a program to determine the potential of the expected resource to meet the CRHR criteria-	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		particularly Criterion 4, the resource's potential to address important research questions identified in the AEP—and the archaeologist shall submit this plan to the ERO for approval. The archaeologist shall then conduct an evaluation consistent with the ERO-approved AEP. The methods and findings of the evaluation shall be presented in an Archaeological Evaluation and Effects Report (AEER), which shall be submitted to the ERO upon completion. Archaeological Data Recovery and Treatment Plan Based on the conclusions of the AEER, the MEA Archaeologist or Designee shall determine if the project will adversely affect a California Environmental Quality Act (CEQA)-significant archaeological resource. If the project will have an adverse effect on such a resource, an Archaeological Research Design and Treatment Plan (ARDTP) shall be prepared by the archaeologist and submitted to the ERO. Once approved by the ERO, a data-recovery investigation and/or other treatment, consistent with the ARDTP, shall be conducted by the archaeologist. Human Remains and Associated or Unassociated Funerary Objects The treatment of human remains and of associated or unassociated funerary objects discovered during any soil-disturbing activity shall comply with applicable State laws. This shall include immediate notification of the coroner of the county within which the project is located and, in the event of the coroner's determination that the human remains are Native American, notification of the California State Native American Heritage Commission (NAHC), who shall appoint a Most Likely Descendant (MLD) (PRC Section 5097.98). The archaeological consultant, project sponsor, and MLD shall make all reasonable efforts to develop an agreement for the treatment, with appropriate dignity, of human remains and associated or unassociated funerary objects (State CEQA Guidelines Section 15064.5(d)). The agreement should take into consideration the appropriate excavation, removal, recordation, analysis, custodianship, curation, and final disposition of the human remains and associated or unassociated funerary objects. California Public Resources Code allows 24 hours to reach agreement on these matters. If the MLD and the other parties do not agree on the reburial method, the Project will follow Section 5097.98(b) of the California Public Resources Code, which states that “the landowner or his or her authorized representative shall reinter the human remains and items associated with Native American burials with appropriate dignity on the property in a location not subject to further subsurface disturbance.”	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		Archaeological Data Recovery Report The archaeologist shall submit a draft Archaeological Data Recovery Report (ADRR) to the ERO that describes the archaeological and historical research methods employed in the archaeological evaluation/monitoring/data recovery program(s) undertaken, and presents, analyses, and interprets the recovered data. Information that may put at risk any archaeological resource shall be provided in a separate removable insert within the final report. Once approved by the ERO, copies of the ADRR shall be distributed as follows: the relevant California Historical Resources Information System Information Center shall receive one copy and the ERO shall receive a copy of the transmittal of the ADRR to the Information Center. MEA shall receive three copies of the ADRR, along with copies of any formal site recordation forms (California Department of Parks and Recreation (CA DPR) 523 series) and/or documentation for evaluation under NRHP/CRHP criteria. In instances of high public interest or high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.	
4.10.2 Impact of construction activities on unknown archaeological resources.	S	5.10.2 Archaeological Measure II: Accidental Discovery Measures SFPUC Construction Measure #9 for cultural resources requires that construction activities be suspended immediately if there is any indication of an archaeological resource. To avoid any potentially significant adverse effect from the proposed project on accidentally discovered buried or submerged historical resources as defined in State CEQA Guidelines Section 15064.5(a)(c), the project sponsor shall distribute the Planning Department's archaeological resource "ALERT" sheet to the project prime contractor; to any project subcontractor firms (including demolition, excavation, grading, foundation, pile driving); and/or to utilities firm involved in soil-disturbing activities within the project site. Prior to any soils-disturbing activities being undertaken, each contractor is responsible for ensuring that the "ALERT" sheet is circulated to all field personnel, such as machine operators, field crew, pile drivers, and supervisory personnel. The project sponsor shall provide the ERO with a signed affidavit from the responsible parties (prime contractor, subcontractor(s), and utilities firm) confirming that all field personnel have received copies of the "ALERT" sheet. If the ERO determines that an archaeological resource may be present within the project site, the project sponsor shall retain the services of a qualified archaeological consultant. The archaeological consultant shall advise the ERO as to whether the discovery is an	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		archaeological resource that retains sufficient integrity and is of potential scientific/historical/cultural significance. If an archaeological resource is present, the archaeological consultant shall identify and evaluate the archaeological resource. The archaeological consultant shall make a recommendation as to what action, if any, is warranted. Based on this information, the ERO may require, if warranted, specific additional measures to be implemented by the project sponsor. Measures might include: preservation in situ of the archaeological resource; an archaeological monitoring program; or an archaeological evaluation program. If an archaeological monitoring program or archaeological testing program is required, it shall be consistent with this measure. The ERO may also require that the project sponsor immediately implement a site security program if the archaeological resource is at risk from vandalism, looting, or other damaging actions. The project archaeological consultant shall submit an accidental discovery ADRR to the ERO which, in addition to the usual contents of the ADRR, includes an evaluation of the historical significance of any discovered archaeological resource, as well as describing the archaeological and historical research methods employed in the archaeological monitoring/data recovery program(s) undertaken, and presenting, analyzing, and interpreting the recovered data. Information that may put at risk any archaeological resource shall be provided in a separate removable insert within the final report. Once approved by the ERO, copies of the ADRR shall be distributed as follows: the relevant California Historical Resources Information System Information Center shall receive one copy and the ERO shall receive a copy of the transmittal letter of the ADRR to the Information Center. The MEA shall receive three copies of the ADRR along with copies of any formal site recordation forms (CA DPR 523 series) and/or documentation for nomination to the National Register of Historic Places/California Register of Historical Resources. The SFPUC shall receive copies of the ADRR in the number requested. In instances of high public interest in or the high interpretive value of the resource, the ERO may require a different final report content, format, and distribution than that presented above.	
4.10.3 Impact of restoration of reservoir water levels and project operations on archaeological resources.	S	Same as Cultural Resources Mitigation Measure 5.10.1, above.	LSM
4.10.4 Construction impacts on historic architectural resources.	NI	No mitigation necessary.	NI

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.10.5 Construction impacts on unknown paleontological resources.	S	5.10.5 Paleontological Resources Training Prior to the initiation of site preparation and/or start of construction, SFPUC shall ensure that all construction forepersons and field supervisors receive training overseen by a qualified professional paleontologist, as defined by the Society of Vertebrate Paleontology's (SVP) Conformable Impact Mitigation Guidelines Committee (1995) and who is experienced in teaching non-specialists, to ensure that they can recognize fossil materials in the event any are discovered during construction. Training on paleontological resources shall also be provided to all other construction workers but may include videotape of the initial training and/or the use of written materials rather than in-person training by a paleontologist. Conduct Pre-Construction Surveys for Significant Paleontological Resources in Areas of Undetermined and High Paleontological Sensitivity Prior to construction, the SFPUC will implement the following: • Contract with a California Registered Geologist (California RG) or a qualified professional paleontologist, as defined by the SVP's Conformable Impact Mitigation Guidelines Committee (1995), to conduct a more detailed evaluation of potential paleontological resources in those areas of the project identified as undetermined or highly sensitive for paleontological resources. • The evaluation will include a thorough literature-based and field-reconnaissance survey of the potentially sensitive areas where excavation activities are planned. The field survey will be limited to identifying potentially significant features at the surface. • The evaluation will be documented in a report to be submitted for review and approval by the ERO prior to the start of construction. • If the evaluation and survey result in the discovery of a paleontological resource exposed at the surface, or confirm the potential for impacts on significant paleontological resources, Mitigation Measures 5.10.5 and 5.10.6 will also be implemented. Mitigation Measure 5.10.3 will be implemented as a safeguard regardless of the identified likelihood of potential impacts.	LSM

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		Perform Pre-Construction Surface Salvage of Any Significant Paleontological Resources Discovered If a significant paleontological resource is discovered at the ground's surface as a result of preconstruction surveys conducted per Mitigation Measure 5.10.4 and cannot be avoided through exclusion of the area from project disturbance (e.g., through the installation of exclusion fencing), the SFPUC will retain a California RG or a qualified professional paleontologist (as defined in Mitigation Measure 5.10.4) to salvage and treat the resource prior to construction in the immediate vicinity of the find. Salvage of the resource would include recovering the item and properly documenting, preparing, and curating the find. Treatment of the resource may include preparation and recovery of fossil materials for housing in an appropriate museum or university collection, and may also include preparation of a report for publication describing the find. No construction activities at the location of the find will be allowed until the salvage operation is completed and authorization is provided by the SFPUC. Conduct Paleontological Resources Monitoring during Construction in Areas of Undetermined and High Paleontological Sensitivity, as Required If determined necessary after implementation of Mitigation Measure 5.10.4, SFPUC will retain a qualified professional paleontologist, as defined by the SVP's Conformable Impact Mitigation Guidelines Committee (SVP 1995), to conduct onsite monitoring for unanticipated discovery of potentially significant paleontological resources during initial ground disturbing activities (e.g., grading and excavation) in the areas with geological units identified as undetermined or highly sensitive for paleontological resources, and as field-verified by the qualified paleontologist. After initial ground disturbance activities in the paleontologically sensitive areas, monitoring will cease but a paleontologist will be retained on-call by the SFPUC and its contractor throughout the project in the event of an unanticipated find during subsequent construction activities. If potential fossils are discovered during construction, all earthwork or other types of ground-disturbance in the vicinity of the find will stop immediately until a qualified professional paleontologist, as defined by the SVP's Conformable Impact Mitigation Guidelines Committee (SVP 1995), can assess the nature and importance of the find and recommend appropriate salvage and treatment (as described in Mitigation Measure 5.10.5). The SFPUC will be responsible for ensuring that the recommendations of the	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		paleontological monitor regarding treatment and reporting are implemented and reported to the San Francisco Planning Department.	
4.10.6 Impact of restoration of reservoir water levels and project operations on unknown paleontological resources.	LS	No mitigation necessary.	LS
4.11 Visual Resources			
4.11.1 Impact of construction activities on scenic vistas, scenic resources, and visual character when viewed from the Sunol Wilderness.	S (temporary)	No mitigation available.	SU (temporary)
4.11.2 Impact of site disturbance on scenic vistas, scenic resources, and visual character when viewed from the Sunol Wilderness.	S	Vegetation and Wildlife Mitigation Measure 5.4.2 would reduce, but not eliminate, the significant impact.	SU
4.11.3 Impact of project operations on scenic vistas, scenic resources, and visual character when viewed from the Sunol Wilderness.	LS	No mitigation necessary.	LS
4.11.4 Impact of construction activities and site disturbance on scenic views from county roads.	LS	No mitigation necessary.	LS
4.11.5 Impact of construction activities on nighttime light conditions.	LS	No mitigation necessary.	LS
4.11.6 Impact of project operations on scenic views from county roads.	LS	No mitigation necessary.	LS
4.12 Transportation and Circulation			
4.12.1 Traffic delays due to temporary lane and road closures during construction.	LS	No mitigation necessary.	LS
4.12.2 Short-term traffic increases on area roadways due to construction-related traffic.	LS	No mitigation necessary.	LS
4.12.3 Impaired access to adjacent roadways and land uses for emergency service providers.	LS	No mitigation necessary.	LS

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.12.4 Increased potential for traffic safety hazards for vehicles and bicyclists on public roadways during construction.	S	5.12.4a Traffic Control Plan The SFPUC or its contractor(s) shall prepare and implement a Traffic Control Plan. To the extent applicable, the Traffic Control Plan should conform to the state's Manual of Traffic Controls for Construction and Maintenance Work Areas. As applicable, elements of the Traffic Control Plan should be coordinated with applicable agencies and include, but are not necessarily limited to, the following: • Advance warning signs shall be installed on Calaveras Road north of Geary Road and on Felter Road and East Calaveras Road south of the dam advising motorists of the construction zone ahead to minimize hazards associated with potential conflict with construction vehicles and to notify motorists of weekday closure of Calaveras Road between Geary Road and Felter Road. • The SFPUC shall develop a program to notify the potential users (including drivers, bicyclists, and pedestrians) of Calaveras Road between Geary Road and Felter Road of the schedule of roadway closures, detour route for vehicles, and alternate recreational bicycle routes. The SFPUC shall disseminate this information by posting signs along Calaveras Road north and south of the dam, providing up to date details to the East Bay Regional Park District, Alameda County and Santa Clara County, and posting this information on a project website or other easily-accessible media. • Either flaggers, illuminated signs, a temporary stoplight, a flashing yellow light, or a combination of these methods shall be utilized to slow approaching traffic at project access points on Calaveras Road at Geary Road and at Felter Road. • Locations shall be identified for parking by construction workers within the established work area. • Construction shall be coordinated with police and fire, local hospitals, and schools. Operators shall be notified in advance of the timing, location, and duration of construction activities and the location of detours and roadway closures. • Public roadway rights-of-way shall be repaired or restored to their pre-construction conditions upon completion of construction. The SFPUC shall inspect and document the condition of Calaveras Road prior to and after completion of the project and, if roadway damage is detected, enter into an agreement with Alameda and Santa Clara Counties for implementing a post-construction roadway repair/rehabilitation program. At a minimum, roads damaged by the project shall be	SU

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		repaired to a structural condition equal to that which existed prior to the project construction activities. Maintenance of adequate driving and bicycling conditions of Calaveras Road during the construction period shall also be addressed. To the extent applicable, the traffic control plan shall conform to the <i>California Manual on Uniform Traffic Control Devices for Streets and Highway: Part 6 Temporary Traffic Control</i> (Caltrans 2006). 5.12.4b Approval for Road Closures The SFPUC shall seek approval from Alameda County for closure of Calaveras Road between Geary Road and the dam site, to through traffic, Monday to Friday, except for emergency vehicles, during 2 periods when hauling on Calaveras Road from Geary Road to the dam site would create substantial conflicts with other vehicles. These two periods are estimated to occur for 2 months in summer 2011 and 18 months beginning in winter 2012. The SFPUC shall also seek approval from Santa Clara County for either (1) closure of the Calaveras Road between the dam site and Felter Road, to through traffic, Monday to Friday, except emergency vehicles, to avoid creating a 7-mile long dead-end with no outlet, or (2) constructing a turnaround at the dam site and installing signage at Felter Road advising of no outlet 7-miles up the road due to construction for the same 2 periods.	
4.12.5 Increased wear and tear on the designated haul routes used by construction vehicles.	S	See Transportation and Circulation Mitigation Measure 5.12.4a.	LSM
4.12.6 Long-term traffic associated with operation and maintenance of the replacement dam.	LS	No mitigation necessary.	LS
4.13 Air Quality			
4.13.1 Impact of short-term increases in emissions of criteria air pollutants and precursors.	S	5.13.1a Fugitive dust mitigation measures recommended by the Bay Area Air Quality Management District The SFPUC shall implement the following BAAQMD-recommended mitigation measures to reduce emissions of fugitive dust (particulate matter, or PM₁₀) from construction activities: - Water all active construction areas at least twice daily. - Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least 2 feet of freeboard.	LSM SU

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Pave, apply water three times daily, or apply (nontoxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at the construction site. • Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas at construction sites. • Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets. • Hydroseed or apply (nontoxic) soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more). • Enclose, cover, water twice daily, or apply (nontoxic) soil binders to exposed stockpiles (dirt, sand). • Limit traffic speeds on unpaved roads to 15 miles per hour or as allowed by the BAAQMD based on site conditions. • Replant vegetation in disturbed areas as quickly as possible. 5.13.1b BAAQMD-recommended exhaust emissions mitigation measures The SFPUC shall implement the following BAAQMD-recommended mitigation measures to reduce exhaust emissions of reactive organic gases, nitrogen oxides, and PM₁₀ from construction activities: • Use grid power instead of diesel generators at all construction sites where it is feasible to connect to grid power. • In contract specifications, include California Code of Regulations, Title 13, Sections 2480 and 2485, which limit the idling of all diesel-fueled commercial vehicles (weighing over 10,000 pounds) to 5 minutes at any location. This requirement shall also apply to barges in the event that Haul Option 2 is selected. In addition, limit the use of diesel auxiliary power systems and main engines to 5 minutes when within 100 feet of homes while the driver is resting; this would not apply to the SFPUC watershed keeper's residence, which would be vacated. • Minimize idling time to a maximum of 5 minutes for all of all non-commuting diesel vehicles and equipment.	

Table S.2 (Continued)

Impact		Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
			Locate staging areas and equipment maintenance activities as far from sensitive receptors as possible. Develop a schedule of low-emissions tune-ups and perform such tune-ups on all equipment. A log of required tune-ups shall be maintained and a copy of the log submitted to the SFPUC on a monthly basis for review. In addition, all equipment shall be maintained in good working order and properly tuned in accordance with manufacturers' specifications. See also Air Quality Mitigation Measure 5.13.3a and 5.13.3b, and Hazards and Hazardous Materials Mitigation Measure 5.9.2a.	
4.13.2	Impact of long-term generation of regional and local criteria air pollutants and precursors.	LS	No mitigation necessary.	LS
4.13.3	Impact of exposing nearby populations to short-term project-generated emissions of diesel PM.		5.13.3a Diesel Particulate Matter Reduction - Off-road Equipment The SFPUC shall ensure that construction-contract specifications include a requirement that all off-road diesel construction equipment is equipped with U.S. Environmental Protection Agency Tier 2 diesel engines as defined in U.S. Code of Federal Regulations, Title 40, Part 89 and are equipped with California Air Resources Board Level 3 Diesel Emission Control Strategies as defined in Title 13, California Code of Regulations, §§2700 through 2710. The construction-contract specifications will require the contractor to submit a comprehensive inventory of all off-road construction equipment that will be used during any portion of the construction project. The inventory shall include each piece of equipment's license plate number, horsepower rating, engine production year, confirmation that the equipment contains a Level 3 abatement device verified by the California Air Resources Board, and projected hours of use or fuel throughput for each piece of equipment. The contractor shall update the inventory and submit it monthly to the SFPUC throughout the duration of the project. 5.13.3b Diesel Particulate Matter Reduction - On-site Haul Trucks and Idling Limits The SFPUC shall ensure that diesel-fueled haul trucks restricted to onsite routes are model year 2004 or newer. See also Air Quality Mitigation Measure 5.13.1b.	LSM
4.13.4	Impact of exposing sensitive receptors to long-term emissions of TACs.	NI	No mitigation necessary.	NI

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.13.5 Impact of exposing sensitive receptors to emissions of odors.	LS	No mitigation necessary.	LS
4.13.6 Impact of increasing criteria air pollutant and ozone precursor emissions that would conflict with or obstruct implementation of the applicable air quality plan.	LS	No mitigation necessary.	LS
4.13.7 Impact of increasing GHG emissions that conflict with the state goal of reducing GHG emissions in California to 1990 levels by 2020 (e.g., a substantial contribution to global climate change) or conflict with San Francisco's Climate Action Plan such that emissions would impede implementation of the local GHG reduction goals established by San Francisco's 2008 Greenhouse Gas Reduction Ordinance.	LS Under the newly proposed BAAQMD construction emissions CEQA thresholds of significance: S	No mitigation necessary. See Air Quality Mitigation Measures 5.13.1b, 5.13.3a, and 5.13.3b.	LS SU
4.14 Noise and Vibration			
4.14.1 Disturbance from temporary construction-related noise increases.	S	5.14.1 Noise Controls The SFPUC shall incorporate into contract specifications a requirement that construction noise shall not exceed the following ordinance daytime and nighttime noise limits to the extent feasible: 63 and 53 A-weighted decibels (dBA), respectively (energy equivalent noise level [Leq]; Table B11-152 of Section B11-152 of the Santa Clara County Code) for mobile equipment, and 60 dBA and 50 dBA (Leq), respectively, as required in Section B11-154(6)(a) of the Santa Clara County Code, for stationary equipment at receptors located in Santa Clara County; 58 and 53 dBA, respectively (Leq: Table 6.60.040A in Section 6.60.040 of the Alameda County General Code) for all equipment at receptors located in Alameda County. In addition, daytime construction noise levels shall not exceed the 70-dBA speech interference criterion and nighttime construction noise levels will not exceed the 50-dBA sleep interference criterion at sensitive receptors. Since most receptors are located 3,000 feet or more from project construction areas, noise attenuation rates over such long distances can vary depending on atmospheric absorption and topographic characteristics. Since project-related construction noise level estimates presented in Tables 4.14.5 and	SU

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		4.14.6, in Section 4.14, Noise and Vibration, only exceed the 50-dBA sleep interference criterion by 1 dBA, it is possible that no noise control measures will be needed to meet these criteria or ordinance noise limits at the closest sensitive receptors. However, if noise levels are found to exceed these criteria or noise ordinance limits, measures that could be implemented to reduce noise levels include the following: Noise generated by nighttime operations (10 p.m. to 7 a.m.) in the outer margins of Borrow Area E and at Staging Area 11 shall be limited as necessary to ensure that this facility can meet the nighttime noise ordinance limit (Santa Clara County Code limits mobile equipment to 53 dBA and stationary equipment to 50 dBA) and not exceed the 50-dBA sleep interference criterion at Receptor B and any other more distant residential receptors. To meet these criteria at this receptor or if certain types of peak noise events occur and become disturbing (e.g., banging or hammering at the repair facility or use of backup beepers), it may become necessary to enclose equipment repair facilities or restrict noise-generating activities during the night to ensure that all nighttime operations associated with the borrow and staging areas minimize the potential for sleep disturbance at this receptor. Implement feasible noise controls on all equipment operating in Borrow Area E and Staging Area 11, such as the following: • Use best available noise control techniques (including mufflers, intake silencers, ducts, engine enclosures, and acoustically attenuating shields or shrouds) for all equipment and trucks in order to minimize construction noise impacts. • Locate stationary noise sources as far from sensitive receptors as feasible when space is available and there is no conflict with worker safety. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate when space is available and there is no conflict with worker safety) will be used to meet local noise ordinance limits to the extent feasible. Enclosure opening or venting should face away from sensitive receptors. If any stationary equipment (e.g., generators) is operated beyond the time limits specified by the pertinent noise ordinance, this equipment should conform to the affected jurisdiction's pertinent day and night noise limits at the receptor sites.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		• Locate material stockpiles as well as maintenance/equipment staging and parking areas as far from the closest residential receptors as possible. Alternatively, enclose any equipment repair facilities as necessary to ensure that the closest residents are not disturbed by nighttime noise. • Prohibit haul and delivery trucks from operating within 200 feet of any residential uses during the nighttime hours (10 p.m. to 7 a.m.) if noise levels exceed the nighttime thresholds. If sensitive receptors are beyond 200 feet from the haul route, then limited truck operations shall be allowed between 10 p.m. to 7 a.m.; however, noise generated by these operations cannot exceed the 50-dBA sleep interference criterion at the closest receptors. • Designate a project liaison to be responsible for responding to noise complaints during the construction phases. The name and phone number of the liaison will be conspicuously posted at construction areas and on all advanced notifications. This person will take steps to resolve complaints, including periodic noise monitoring, if necessary. Results of noise monitoring will be presented at regular project meetings with the project contractor, and the liaison will coordinate with the contractor to modify any construction activities that generated excessive noise levels. • Require a reporting program that documents complaints received, actions taken to resolve problems, and effectiveness of these actions. • If impact equipment (e.g., jack hammers, pavement breakers, and rock drills) is used during project construction, use hydraulically or electric-powered equipment wherever feasible to safely conduct the required activity to avoid the noise associated with compressed-air exhaust from pneumatically powered tools. However, where use of pneumatically powered tools is unavoidable, an exhaust muffler on the compressed-air exhaust will be used if required to reduce noise levels to within acceptable thresholds (a muffler can lower noise levels from the exhaust by up to about 10 dBA). External jackets on the tools themselves will be used, if required to reduce noise levels to within acceptable thresholds, which could achieve a reduction of 5 dBA. Quieter procedures, such as drilling rather than impact equipment, will be used whenever feasible to safely conduct the required activity.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
		- If pile driving is used for construction of the jetty in the southern portion of the reservoir, use sonic or vibratory pile drivers instead of impact pile drivers wherever feasible depending on site or soil conditions (sonic pile drivers are only effective in some soils). - Prohibit pile driving activities during the evening and nighttime hours (7 p.m. to 7 a.m.).	
4.14.2 Temporary noise disturbance along construction haul routes.	S	See Noise Mitigation Measure 5.14.1, above.	LSM
4.14.3 Disturbance due to construction-related controlled blasting.	S	5.14.3 Blasting Noise Control If peak noise events associated with controlled blasting are found to exceed the Alameda County Noise Ordinance maximum noise limit of 70 dBA (L_{max}) at any Alameda County residential receptors or 75 dBA (L_{max}) at any Santa Clara County residential receptors, blasting charges shall be modified to be consistent with these noise limits, which would require blasting charges to be reduced so that noise levels do not exceed 112 dBA (L_{max}) at 50 feet or 106 dBA (L_{max}) at 100 feet. Alternatively, if blasting charges cannot be reduced sufficiently, then frequency of blasting (number of blast events during any given day or hour) shall be reduced to meet ordinance noise limits.	LSM
4.14.4 Disturbance due to construction-related vibration.	LS	No mitigation necessary.	LS
4.14.5 Disturbance due to long-term noise increases associated with operation of project facilities.	LS	No mitigation necessary.	LS
Cumulative Noise and Vibration Impact		5.17.1 Restrict Truck Operations at Night The SFPUC shall restrict total truck volumes from all WSIP projects on Calaveras Road near the watershed keeper's residence (located approximately 225 feet east of the road) to 60 vehicles and 30 trucks per hour during nighttime hours or another vehicle mix that will achieve the 50-dBA sleep interference threshold. Truck traffic shall be coordinated through the SFPUC WSIP construction coordinator designated in Mitigation Measure 6.1.	

Table S.2 (Continued)

Impact	Level of Significance Before Mitigation	Mitigation Measure	Level of Significance After Mitigation
4.15 Utilities, Service Systems, and Public Services			
4.15.1 Impact of construction activities on the demand for fire protection services.	LS	No mitigation necessary.	LS
4.15.2 Impact of construction activities on the demand for law enforcement services.	LS	No mitigation necessary.	LS
4.15.3 Impact of construction activities on the demand for landfill capacity.	LS	No mitigation necessary.	LS
4.15.4 Impact of construction activities on electrical transmission lines to Calaveras Dam and related structures.	LS	No mitigation necessary.	LS
4.16 Mineral and Energy Resources			
4.16.1 Impact of using rock, clay, and sand to construct the replacement dam.	LS	No mitigation necessary.	LS
4.16.2 Impact of temporary increase in energy use to construct the replacement dam.	S	See Air Quality Mitigation Measure 5.13.1b, above.	LSM
4.16.3 Impact of using electric power to operate the replacement dam and filled reservoir.	NI	No mitigation necessary.	NI

Note:

* The following abbreviations are used to denote level of significance:

LS – Less than significant

S – Significant

LSM – Less than significant with mitigation

SU – Significant and unavoidable

NI – No impact

B – Beneficial

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2. INTRODUCTION AND BACKGROUND

Chapter 2 Contents

- 2.1 Introduction
- 2.2 Project Background
 - 2.2.1 SFPUC Regional Water System Overview
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2.1 INTRODUCTION

The City and County of San Francisco, through the San Francisco Public Utilities Commission (SFPUC), owns and operates a regional water system that includes Calaveras Dam and Reservoir. The proposed Calaveras Dam Replacement Project (CDRP) is one of the SFPUC's Water System Improvement Program (WSIP) projects and the subject of this Environmental Impact Report (EIR).

In 2001, the California Department of Water Resources, Division of Safety of Dams (DSOD) restricted the water level of Calaveras Reservoir until the dam's seismic safety could be demonstrated. The SFPUC decided that the best way to address safety concerns would be to replace Calaveras Dam. The proposed replacement dam would be a 2.8-million-cubic-yard earth and rockfill structure located immediately downstream at the foot of the existing dam. The replacement dam would be constructed over a 4-year period, beginning in 2011. When the dam is completed, the reservoir water level can be restored to its original level.

This chapter presents an overview of the regional water system and the WSIP. It then describes the CDRP EIR's purpose, review and approval process, and organization.

2.2 PROJECT BACKGROUND

2.2.1 SFPUC REGIONAL WATER SYSTEM OVERVIEW

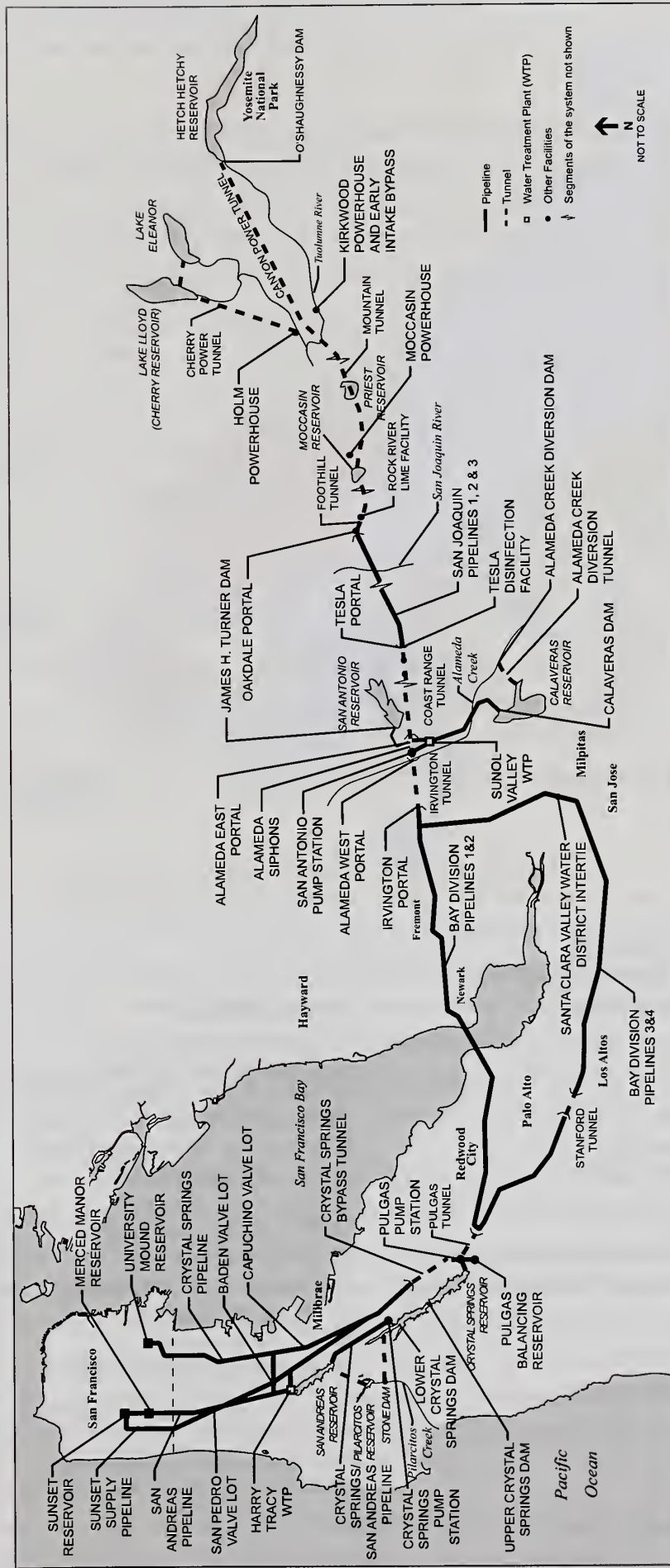
The City and County of San Francisco, through the SFPUC, owns and operates a regional water system that extends from the Sierra Nevada to San Francisco and serves 2.4 million people in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The regional water system consists of water conveyance, treatment, and distribution facilities, and delivers water to retail and wholesale customers. The existing regional system includes over 280 miles of pipelines, over 60 miles of tunnels, 11 reservoirs, 5 pump stations, and 2 water treatment plants. Calaveras Dam and Reservoir are part of this regional water supply system. The SFPUC currently delivers an annual average of about 265 million gallons per day (mgd) of water to its customers. The source of the water supply is a combination of local supplies from streamflow and runoff in the Alameda Creek watershed and in the San Mateo and Pilarcitos Creeks watersheds (referred to together as the Peninsula watersheds), augmented with imported supplies from the Tuolumne River watershed. Local watersheds provide about 15 percent of total supplies and the Tuolumne River provides the remaining 85 percent. Figure 2.1, SFPUC Regional Water Supply System, illustrates the general location of the SFPUC regional system and water supply watersheds.

The SFPUC serves about one-third of its water supplies directly to retail customers, primarily in San Francisco, and about two-thirds of its water supplies to wholesale customers by contractual agreement. The wholesale customers are largely represented by the Bay Area Water Supply and Conservation Agency (BAWSCA), which consists of 27 total customers, shown in Figure 2.2, SFPUC Water Service Area – San Francisco and SFPUC Wholesale Customers. Some of these wholesale customers have other sources of water in addition to what they receive from the SFPUC regional system, while others rely completely on the SFPUC for supply.

2.2.2 SFPUC WATER SYSTEM IMPROVEMENT PROGRAM

On October 30, 2008, the SFPUC adopted a Water System Improvement Program (known as the “Phased WSIP Variant”) (SFPUC 2008). The adopted WSIP will improve the regional system with respect to water quality, seismic response, and water delivery based on a planning horizon through the year 2030. The WSIP will also improve the regional system with respect to water supply to meet water delivery needs in the service area through the year 2018. The proposed program area spans seven counties: Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco.

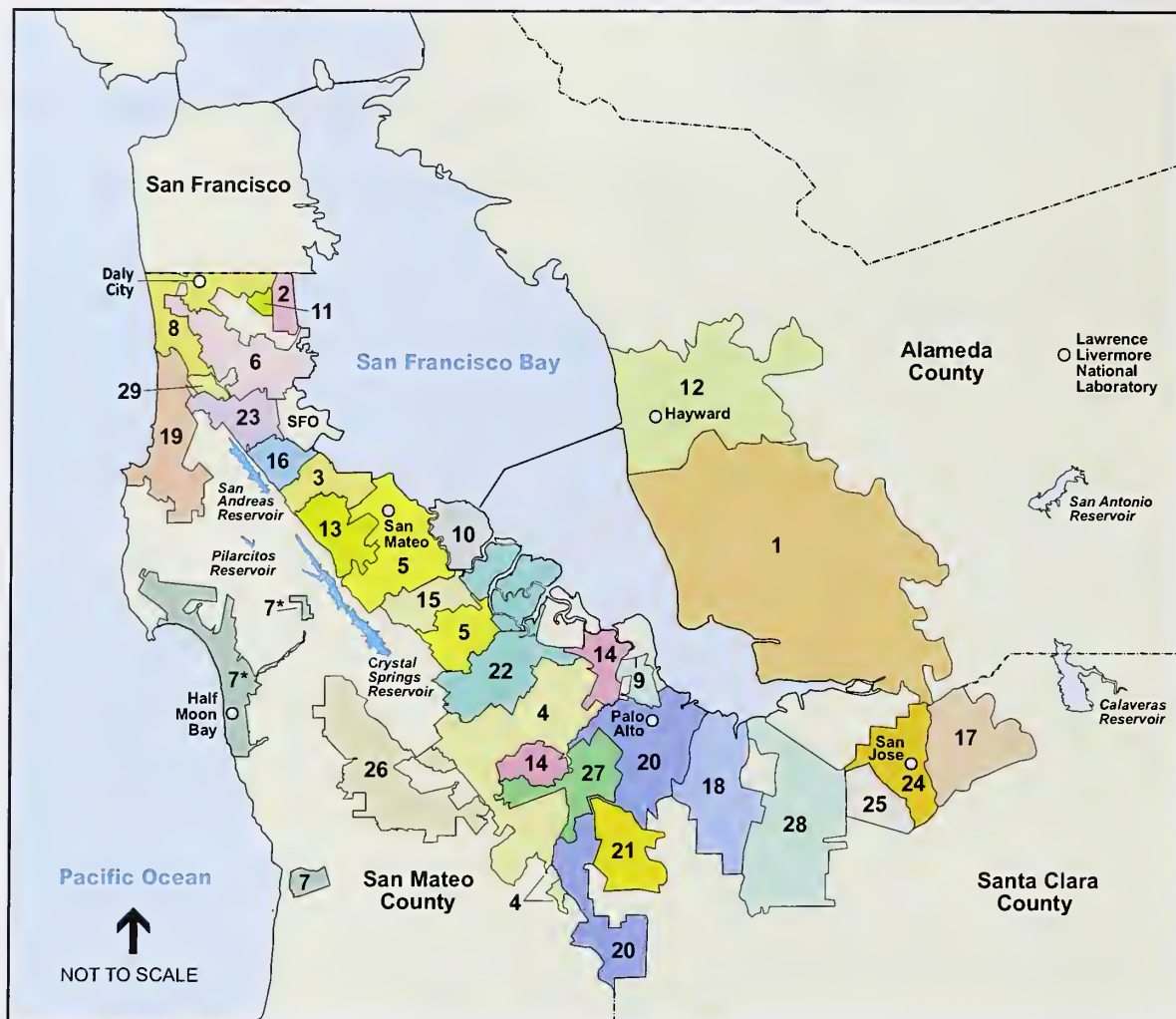
The WSIP includes a water supply strategy, modifications to system operations, and construction of a series of facility improvement projects. The proposed project, along with several other facility improvement projects, is a component of the WSIP. The overall goals of the WSIP are to



SOURCE: San Francisco Public Utilities Commission (2005)

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 2.1: SFPUC REGIONAL WATER SUPPLY SYSTEM



SOURCE: BAWSCA, 2006a

NOTE: For the purposes of this EIR, the California Water Service (CWS) Company is a single wholesale customer with three different water service districts.

maintain high-quality water; reduce vulnerability to earthquakes; increase delivery reliability and improve the ability to maintain the system; meet customer purchase requests in nondrought and drought periods; enhance sustainability in all system activities; and achieve a cost-effective, fully operational system (see Table 2.1). To further these program goals, the WSIP also includes objectives that address system performance in the areas of water quality, seismic reliability, delivery reliability, and water supply.

To address the potential environmental impacts of the WSIP, the San Francisco Planning Department prepared a Program EIR (PEIR), which was certified by the San Francisco Planning Commission on October 30, 2008 (San Francisco Planning Department 2008). At a project level of detail, the PEIR evaluated the environmental impacts of the WSIP's water supply strategy; at a program level of detail, it evaluated the environmental impacts of the WSIP's facility improvement projects. This EIR tiers from the PEIR, and the analyses of the WSIP that are relevant to this project are incorporated by reference into this EIR. Also, to the extent affected by the CDRP, this EIR re-evaluates impacts analyzed as part of the PEIR water supply and system operations analysis for the Alameda Creek watershed. All WSIP-related impacts to which this project contributes have been examined at a sufficient level of detail in the PEIR, enabling those effects to be mitigated or avoided through mitigation measures that are included either as part of the WSIP approval by the SFPUC or revisions that were made to the WSIP by the SFPUC prior to WSIP approval.

2.2.3 REGIONAL WATER SYSTEM FACILITIES¹

Local water supplies from the Alameda Creek watershed enter the regional system in the Sunol Valley and are blended with the Hetch Hetchy water supply. The Alameda watershed generally refers to CCSF-owned lands that are located within the much larger hydrologic boundaries of the southern Alameda Creek watershed. Local water supply sources contributing to the regional water system include Arroyo Hondo and Alameda and Calaveras Creeks, which provide inflow to Calaveras Reservoir, and San Antonio Creek, which flows to San Antonio Reservoir.

The Alameda East Portal is the connection between the Coast Range Tunnel (carrying water from the Hetch Hetchy Reservoir in the Sierra Nevada to the San Joaquin pipelines) and the Alameda Siphons. The Alameda Siphons are three pipelines that cross the Sunol Valley and beneath Alameda Creek. The roughly 3,000-foot-long Alameda Siphons connect the Coast Range Tunnel at the Alameda East Portal to the Irvington Tunnel at the Alameda West Portal. At the Alameda Siphons, Hetch Hetchy water is blended with water from Calaveras and San Antonio Reservoirs that has been treated at the Sunol Valley Water Treatment Plant (SVWTP). Directly adjacent to the Alameda Siphons, the Sunol Valley Chloramination Facility provides secondary disinfection

¹ Section 2.3.3 is based on text from the WSIP PEIR (San Francisco Planning Department 2008), pp. 2-10 - 2-11.

Table 2.1: WSIP Goals and Objectives

Program Goal	System Performance Objective
Water Quality – <i>maintain high quality water</i>	• Design improvements to meet current and foreseeable future federal and state water quality requirements. • Provide clean, unfiltered water originating from Hetch Hetchy Reservoir and filtered water from local watersheds. • Continue to implement watershed protection measures.
Seismic Reliability – <i>reduce vulnerability to earthquakes</i>	• Design improvements to meet current seismic standards. • Deliver basic service to the three regions in the service area (East/South Bay, Peninsula, and San Francisco) within 24 hours after a major earthquake. Basic service is defined as average winter-month usage, and the performance objective for the regional system is 229 million gallons per day (mgd). The performance objective is to provide delivery to at least 70 percent of the turnouts (i.e., water diversion connecting points from the regional system to customers) in each region, with 104, 44 and 81 mgd delivered to East/South Bay, Peninsula, and San Francisco regions, respectively. • Restore facilities to meet average-day demand of up to 300 mgd within 30 days after a major earthquake.
Delivery Reliability – <i>increase delivery reliability and improve the ability to maintain the system</i>	• Provide operational flexibility to allow planned maintenance shutdown of individual facilities without interrupting customer service. • Provide operational flexibility to minimize the risk of service interruption due to unplanned facility upsets or outages. • Provide operational flexibility and system capacity to replenish local reservoirs as needed. • Meet estimated average annual demand of up to 300 mgd under the conditions of one planned shutdown of a major facility for maintenance concurrent with one unplanned facility outage due to a natural disaster, emergency, or facility failure/upset.
Water Supply – <i>meet customer water needs in nondrought and drought periods</i>	• Meet average annual water demand of 265 mgd from the SFPUC watersheds for retail and wholesale customers during nondrought years for system demands through 2018. • Meet dry-year delivery needs through 2018 while limiting rationing to a maximum 20 percent systemwide reduction in water service during extended droughts. • Diversify water supply options during nondrought and drought periods. • Improve use of new water sources and drought management, including groundwater, recycled water, conservation, and transfers
Sustainability – <i>enhance sustainability in all system activities</i>	• Manage natural resources and physical systems to protect watershed ecosystems. • Meet, at a minimum, all current and anticipated legal requirements for protection of fish and wildlife habitat. • Manage natural resources and physical systems to protect public health and safety.
Cost-effectiveness – <i>achieve a cost-effective, fully operational system</i>	• Ensure cost-effective use of funds. • Maintain gravity-driven system. • Implement regular inspection and maintenance program for all facilities.

Source: SFPUC Resolution No. 08-0200

with chloramine, along with fluoride addition and pH adjustment for corrosion control, for both Hetch Hetchy water and treated water from the SVWTP prior to transmission to the Bay Area.

Water deliveries to the General Electric pumping facility and individual accounts in the town of Sunol, both retail customers of the SFPUC, occur from two of the siphons at a location downstream of the blending point for treated water with Hetch Hetchy water.

Calaveras Reservoir, located in the Alameda Creek watershed, collects and stores water from the local watershed, including drainage from Calaveras Creek and Arroyo Hondo. The reservoir was originally constructed in 1913 and was completed in 1925. The Alameda Creek Diversion Dam and Tunnel, constructed from 1925 to 1931 following completion of Calaveras Dam, divert flows and drainage from the southern Alameda Creek watershed into Calaveras Reservoir. Water from Calaveras Reservoir flows by gravity through the Calaveras Pipeline to the SVWTP for treatment, and then flows to the Alameda Siphons, where it is blended with the Hetch Hetchy water supply. Water from Calaveras Reservoir can also be transferred for storage to San Antonio Reservoir and later for treatment at the SVWTP.

In 2001, the DSOD performed an evaluation of Calaveras Dam and concluded that the dam does not meet current seismic stability criteria at normal operating levels due to properties of the soil material used in dam construction (DSOD 2003; Olivia Chen Consultants 2003). As a result, the DSOD placed interim operational restrictions on Calaveras Reservoir, lowering the level at which the reservoir can be safely operated and restricting the maximum water elevation to 705 feet. These restrictions reduced the total storage capacity of the reservoir by 60 percent and the total working storage capacity of the SFPUC's local reservoirs by over 30 percent. Due to the DSOD restrictions, the Calaveras system is currently diverting less flow from Alameda Creek via the Alameda Creek Diversion Dam and utilizes less water from Calaveras Reservoir. In addition, in 1991 the SFPUC and the California Department of Fish and Game (CDFG) agreed on a minimum operating level for Calaveras Dam of 690 feet to protect juvenile fish populations. Therefore, under DSOD and CDFG restrictions, the SFPUC currently operates Calaveras Reservoir at water level elevations ranging between 690 and 705 feet to the extent feasible.²

San Antonio Reservoir and Turner Dam, completed in 1965, impound water from San Antonio Creek. This reservoir can also receive and store water from the Hetch Hetchy water supply or from Calaveras Reservoir. Water stored in San Antonio Reservoir must be conveyed in the San Antonio Pipeline to the SVWTP for treatment before it can be added to the regional distribution system at the Alameda Siphons.

² Since December 2001 following periods of heavy inflow, reservoir storage levels have risen temporarily beyond the restricted levels. At such times, the SFPUC employs best efforts to lower the reservoir level by releasing water to the regional system and, if necessary, discharging excess inflow to Calaveras Creek below Calaveras Dam.

The SVWTP was constructed in 1966 and upgraded in 2003 to a peak capacity of 160 mgd (with a sustained capacity of 120 mgd); it can treat water from the local Alameda Creek watershed drainages, including waters stored in both the Calaveras and San Antonio Reservoirs. Water from the Hetch Hetchy system can also be treated at the SVWTP, which is necessary when the water does not meet California Department of Health Services permit conditions as it enters the Sunol Valley (which occurs on rare occasions due to storm events in the Sierra causing high turbidity levels, or to conditions in the San Joaquin Pipelines) and when Hetch Hetchy water is used to maintain water treatment operations at the plant.

Hetch Hetchy water from the Coast Range Tunnel is blended with treated water from the Alameda watershed in the Alameda Siphons, then exits the Sunol Valley at the Alameda West Portal, located at the west end of the Alameda Siphons. Water is conveyed from the Sunol Valley by the 3.5-mile-long Irvington Tunnel and flows by gravity to the city of Fremont in the East Bay.

2.3 PURPOSE OF THIS EIR

The subject of this EIR is the Calaveras Dam Replacement Project, one of the SFPUC's WSIP projects. The San Francisco Planning Department has prepared this EIR pursuant to the requirements of the California Environmental Quality Act (CEQA) in California Public Resources Code Sections 21000 *et seq.*, and the State CEQA Guidelines in California Code of Regulations Title 14, Sections 15000 *et seq.* The EIR is intended to provide the public and decision-making agencies with information about physical environmental impacts that could result from implementation of the proposed CDRP. The EIR is a project-level EIR, as defined in *CEQA Guidelines* Section 15161, evaluating the site-specific impacts of the CDRP. It describes potentially significant impacts, identifies mitigation measures that would avoid or reduce significant impacts to less-than-significant levels, and evaluates feasible alternatives to the proposed project.

As described above in Subsection 2.2.2, SFPUC Water System Improvement Program, the analyses in this EIR tier from the PEIR on the WSIP (for more information about the WSIP and the PEIR, see Subsection 1.2, Overview of the SFPUC Regional Water System, in Chapter 1, Executive Summary). The distinction between the PEIR and this project-level EIR is that the latter focuses solely on the CDRP and offers more detailed analyses of the proposed project than the PEIR does. Also, to the extent affected by the CDRP, this EIR re-evaluates impacts analyzed as part of the PEIR water supply and system operations analysis for the Alameda Creek watershed. This EIR incorporates by reference and summarizes the relevant analyses of the PEIR with respect to the WSIP's impacts and mitigation measures, as applicable to the CDRP.

2.4 CEQA PROCESS

The City and County of San Francisco is the Lead Agency. The Planning Department is designated under the San Francisco Administrative Code, Chapter 31, as the City entity with responsibility for carrying out the City's CEQA responsibilities. The City and County of San Francisco, by and through its SFPUC, is the project sponsor.

The Planning Department has directed several steps in the environmental review process; this Draft EIR is one of the steps.

2.4.1 NOTICE OF PREPARATION AND PUBLIC SCOPING

On October 24, 2005, the Planning Department issued a Notice of Preparation (NOP) of an EIR and Notice of Public Scoping Meetings for the CDRP (see Appendix A, Notice of Preparation). The notice was circulated by mail to local, state, and federal agencies, and to other interested groups and individuals. The notice was also circulated to state agencies through the State Clearinghouse, and published in local newspapers in the East Bay and in San Francisco. An Initial Study was not prepared to decide whether an EIR would be necessary for the proposed project, because the Planning Department determined in advance that an EIR would be required. The public comment period extended from October 26 through November 30, 2005.

Two public scoping meetings were held: one in Fremont, near the project site, on November 14, 2005, and the other in downtown San Francisco on November 15, 2005. Attendees at both meetings received information about the proposed project and the EIR process. During the public comment portion of the scoping meetings, attendees were given an opportunity to provide input regarding issues of concern to the community and identify environmental effects and potential alternatives to be considered in the environmental review process. Attendees who did not wish to speak at the meetings were encouraged to provide written comments to the Planning Department, either at the meeting or mailed to the Department's offices. Written comments were received from 28 organizations and individuals; 9 persons testified at the public meetings.

In addition to the two public scoping meetings, an inter-agency meeting was held on December 15, 2005, by the Planning Department to receive comments directly from state and federal agencies. The meeting was attended by representatives of the U.S. Army Corps of Engineers, the National Environmental Policy Act (NEPA) lead agency; the U.S. Environmental Protection Agency; the National Marine Fisheries Service; and the California Department of Fish and Game. Representatives of the U.S. Fish and Wildlife Service and the San Francisco Bay Regional Water Quality Control Board were also invited but were unable to attend.

A Scoping Report was prepared to summarize the public scoping process and the comments received in response to the NOP (see Appendix B, Public Scoping Process Summary Report).

Comments and testimony received during the public scoping process were reviewed and considered in the preparation of this EIR and have informed the identification and analysis of environmental impacts. The Scoping Report is available for public review at the San Francisco Planning Department, by appointment, at 1650 Mission Street, Suite 400, San Francisco.

2.4.2 DRAFT EIR AND PUBLIC COMMENT

This document is the Draft EIR. It includes a description of the proposed CDRP, a description of the environmental setting and identification of impacts, and a list of mitigation measures for impacts found to be significant. The Draft EIR contains an analysis of a range of reasonable alternatives that would feasibly attain most of the basic project objectives but would avoid or substantially reduce significant impacts. Chapter 7, Alternatives to the Proposed Project, of this EIR identifies an environmentally superior alternative, as required in *CEQA Guidelines* Section 15126.6.

The Draft EIR is available for public review for a 45-day period, beginning on October 6, 2009. Notice of the availability of the Draft EIR was published in newspapers in San Francisco and the East Bay, and copies of the Draft EIR are available for review at the San Francisco Planning Department, the San Francisco Main Library Government Documents Section, the Fremont Main Public Library, and on line at the San Francisco Planning Department website at <http://www.sfgov.org/planning/mea>.

Public hearings will be held to receive comments on the Draft EIR in Fremont by the Environmental Review Officer as delegated by the San Francisco Planning Commission and in San Francisco by the Planning Commission. Public hearings on the Draft EIR are scheduled for the following dates and places:

November 10, 2009, 6:30

Fremont Public Library
2400 Stevenson Blvd.
Fremont, CA 94538

November 12 2009, 1:30 p.m., or later

San Francisco Planning Commission
City Hall, 1 Dr. Carleton B. Goodlett Place
Commission Chambers, Room 400
San Francisco, CA 94102
(Call (415) 558-6422 the week of the hearing for
a recorded message giving a more specific time.)

2.4.3 RESPONSE TO PUBLIC COMMENT AND FINAL EIR

Written responses will be prepared to comments raising environmental issues during the public comment period in a Comments and Responses document. This document will be provided to persons who commented on the Draft EIR and to the San Francisco Planning Commission. The

Planning Commission will consider certification of the EIR, pursuant to *CEQA Guidelines* Section 15090. The Final EIR will be comprised of the Draft EIR, a list of persons commenting on the Draft EIR, the comments received and responses to environmental issues, and revisions to the text of the Draft EIR identified as a result of comments on the Draft and initiated by staff.

After the Final EIR is certified, the SFPUC may consider action on the proposed project. If it approves the project, it must make several determinations related to significant impacts, mitigation measures, and alternatives identified in the EIR, in written findings. These findings will identify significant impacts; determine whether mitigation measures will be required of the project that would reduce significant impacts to less-than-significant levels, or whether mitigation measures are within the jurisdiction of another agency; or find that mitigation measures or alternatives that would reduce significant impacts are infeasible for identified legal, social, economic, technological or other reasons, as provided in Section 15091 of the *CEQA Guidelines*. If significant unavoidable impacts remain after all feasible mitigation measures have been imposed on the project, in order to approve the project, decision-makers must adopt a written statement of overriding considerations explaining how they have balanced these significant impacts against the benefits of the proposed project.

Following certification, a consolidated Final EIR will be prepared, including revisions to the text of the Draft EIR that were identified as a result of responses to comments.

2.5 ORGANIZATION OF THIS EIR

This EIR is made up of three volumes. Volumes 1 and 2 contain the main chapters of the EIR. A List of Acronyms and Abbreviations and a Glossary are located at the beginning of Volume 1. Chapter 1, Executive Summary, briefly describes the proposed project; lists the impacts and mitigation measures identified in the EIR; summarizes the range of alternatives to the proposed project; and identifies areas of controversy and issues to be resolved. This chapter – Chapter 2, Introduction and Background – provides an overview of the regional water supply system owned by the City and County of San Francisco and operated by the SFPUC, as well as a description of the WSIP, to orient the reader. It also includes pertinent information regarding the legal framework under which this EIR has been prepared and the environmental review process for the document. Chapter 3, Project Description, provides details about the proposed project and the approvals required to implement the project (in this chapter, terms defined in the Glossary for this EIR are marked with an asterisk [*] after their first use). Chapter 4, Environmental Setting and Impacts, addresses 15 topics: Plans and Policies; Land Use, Agricultural Resources, and Recreation; Vegetation and Wildlife; Fisheries and Aquatic Habitat; Hydrology; Water Quality; Geology, Soils, and Seismicity; Hazards and Hazardous Materials; Cultural Resources; Visual Resources; Transportation and Circulation; Air Quality; Noise and Vibration; Utilities, Service Systems, and Public Services; and Mineral and Energy Resources. Each section includes the

environmental setting and project-specific impacts. Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, identifies mitigation measures that address project impacts. Chapter 6, Other Topics Required by CEQA, summarizes the cumulative impacts and identifies significant effects of the project that cannot be avoided if the project is implemented. A range of alternatives to the proposed project is discussed in Chapter 7, including the No Project Alternative, as required by *CEQA Guidelines* Section 15126.6(e).

Volume 3 (see the CDs in the pocket on the inside back cover of Volume 1) contains the EIR's 11 appendices.

2.6 BACKGROUND DOCUMENTS

This EIR relies upon information from numerous background sources from many disciplines. Background sources for this EIR have been compiled as part of the project file. They are available for public review at the offices of the San Francisco Planning Department at 1650 Mission Street, San Francisco, CA.

REFERENCES

California Department of Water Resources, Division of Safety of Dams (DSOD). 2003. Letter from Stephen W. Verigin, Chief, Division of Safety of Dams, to Patricia E. Martel, General Manager, San Francisco Public Utilities Commission, regarding Calaveras Dam, No. 10, Alameda County, February 20, 2003, in San Francisco Planning Department, *Final Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program*, October 2008, Volume 1 of 5, Chapter 2, p. 2-46.

Olivia Chen Consultants. 2003. Report on the Seismic Stability of Calaveras Dam, Alameda County, California, in San Francisco Planning Department, *Final Program Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program*, October 2008, Volume 1 of 5, Chapter 2, p. 2-47.

San Francisco Planning Department. 2008. Program Environmental Impact Report on the San Francisco Public Utilities Commission's Water System Improvement Program, October 2008, certified in San Francisco Planning Commission Motion 17734.

San Francisco Public Utilities Commission (SFPUC). 2006. *AB1823: Notice of Changes to Water System Improvement Program*, March 2006.

San Francisco Public Utilities Commission (SFPUC). 2008. Water System Improvement Program California Environmental Quality Act Findings: Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations, October 2008.

3. PROJECT DESCRIPTION

Chapter 3 Contents 3.1 Project Location 3.2 Project Purpose and Objectives 3.2.1 Project Background and Purpose 3.2.2 Project Objectives 3.2.2.1 Water Delivery Reliability 3.2.2.2 Water Supply 3.2.2.3 Seismic Safety and Reliability 3.2.2.4 Robust Design for Potential Future Enlargement 3.2.2.5 Continuation of Reservoir Operation During Construction 3.2.2.6 Water Quality 3.3 Overview of the Existing Dam and Reservoir 3.3.1 Existing Dam 3.3.1.1 Spillway 3.3.1.2 Outlet Works 3.3.1.3 Control Valves 3.3.2 Existing Reservoir 3.3.2.1 Drainage Area and Storage Capacity 3.3.2.2 Water Quality 3.3.3 Other Existing Structures 3.3.4 Operation 3.3.4.1 Water Supply Withdrawals 3.3.4.2 Spillway and Valve Releases 3.3.4.3 Alameda Creek Diversion 3.3.4.4 Operating Staff 3.3.4.5 Reservoir Limnology 3.3.4.6 On-Site Water Treatment 3.4 Proposed Project Elements 3.4.1 Design Criteria 3.4.2 Design and Composition of the Replacement Dam 3.4.2.1 Spillway 3.4.2.2 Intake Shaft and Adits 3.4.2.3 Outlet Pipe and Stream Discharge Valves 3.4.2.4 Supporting Facilities 3.4.2.5 Instrumentation	3.4.3 Alameda Creek Diversion Dam Bypass Facility 3.5 Project Construction 3.5.1 Construction of Replacement Dam 3.5.1.1 Use of the Existing Dam as the Cofferdam 3.5.1.2 Excavation and Construction of the Foundation and Embankment 3.5.1.3 Excavation and Construction of the Spillway 3.5.1.4 Sources of Material for Construction 3.5.1.5 Construction Staging Areas 3.5.1.6 Disposal Sites 3.5.1.7 Access and Roads 3.5.1.8 Demolition and Construction of Support Buildings 3.5.1.9 Blasting 3.5.2 Construction of Alameda Creek Diversion Dam Bypass Facility 3.5.3 SFPUC Standard Construction Measures for WSIP Projects 3.5.4 Greenhouse Gas Reduction Actions 3.5.5 Construction Schedule 3.5.6 Operation of the Reservoir During Construction 3.6 Project Operation 3.6.1 Local Reservoirs 3.6.2 Calaveras Reservoir Operations 3.6.3 Cone Valve Operations 3.6.4 Alameda Creek Diversion Dam Operations 3.6.5 Resident Rainbow Trout Flow Releases 3.6.6 Steelhead Flow Releases 3.7 Discretionary Approvals and Agencies Involved 3.7.1 California Environmental Quality Act 3.7.2 National Environmental Policy Act 3.7.3 Agency Approvals References
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Chapter 3 describes the facilities and activities that comprise the proposed Calaveras Dam Replacement Project (CDRP). This chapter identifies the proposed project's location and objectives; the physical features and operating characteristics of the existing dam, associated facilities (the spillway^{*1}, intake shaft*, outlet works*, and buildings), and reservoir; the physical features of the proposed replacement dam and associated structures; project construction activities and sites; and long-term operation of the new dam and associated facilities. This chapter concludes with a discussion of the approvals that would be required for the proposed project.

3.1 PROJECT LOCATION

Calaveras Dam is located on Calaveras Creek in the Diablo Mountain Range in Alameda County, California, approximately 12 miles south of the City of Pleasanton and 7.5 miles east of the City of Fremont. Calaveras Dam forms Calaveras Reservoir*, which is situated on the border between Alameda and Santa Clara Counties (see Figure 3.1: Project Location). Calaveras Reservoir retains flows from Calaveras Creek and Arroyo Hondo, as well as water diverted from upper Alameda Creek (see Figure 3.2: Calaveras Dam Vicinity). Calaveras Dam is located at the northern end of the reservoir, approximately 1 mile upstream from the confluence* of Calaveras and Alameda Creeks. The Alameda Creek Diversion Dam* (ACDD) is located on upper Alameda Creek east of Calaveras Dam, and water is diverted from Alameda Creek to Calaveras Reservoir by means of the Alameda Creek Diversion Tunnel*.

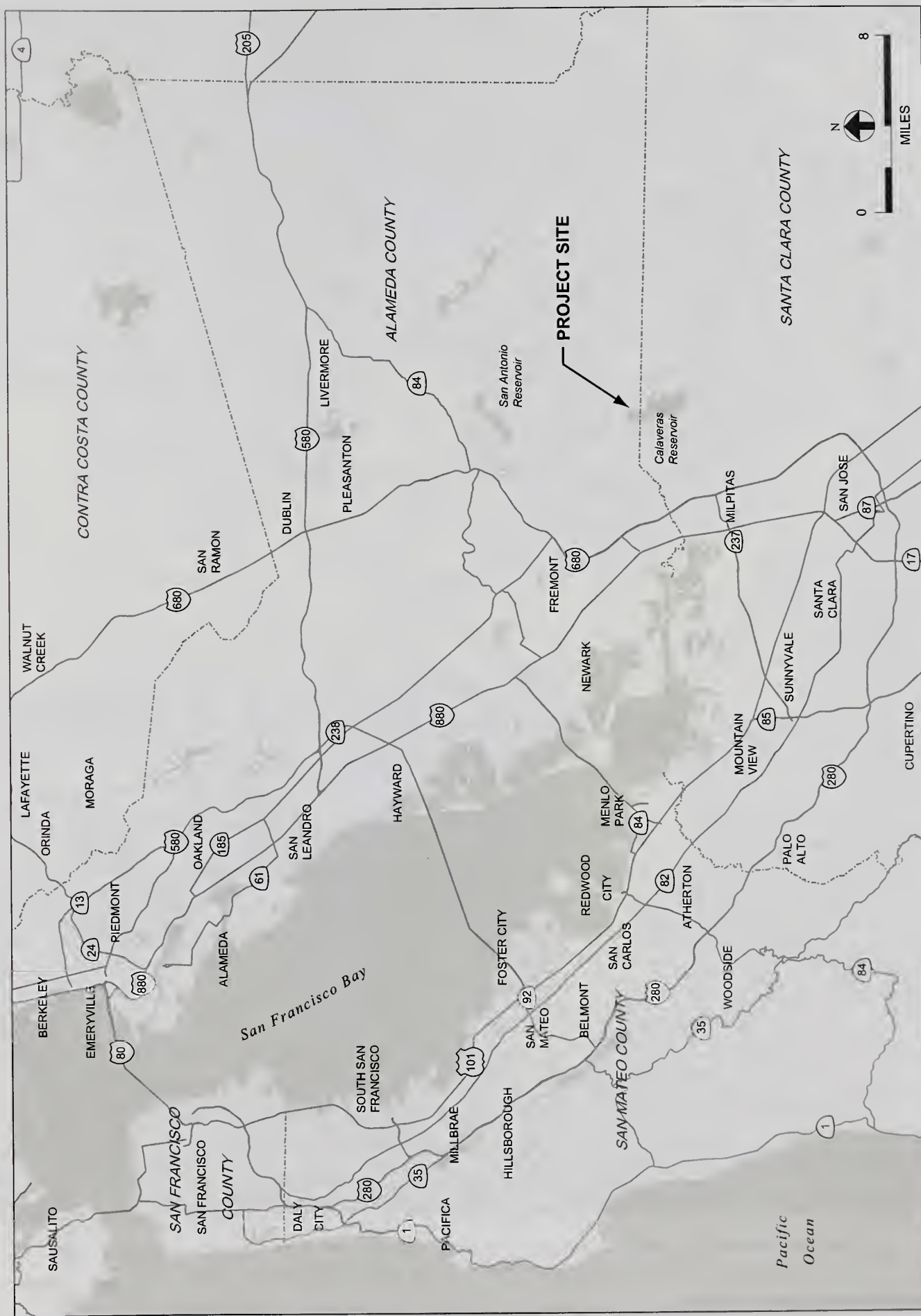
The reservoir, dam, and portions of the Calaveras Creek, Arroyo Hondo, and Alameda Creek watersheds* are owned by and under the jurisdiction of the San Francisco Public Utilities Commission (SFPUC).

3.2 PROJECT PURPOSE AND OBJECTIVES

As described in Chapter 2, Introduction and Background, the proposed project is part of the SFPUC's Water System Improvement Program (WSIP). With the exception of the water supply goal, the WSIP goals and objectives (refer to Table 2-1 in Chapter 2) are based on a planning horizon through 2030. The water supply goal is based on a planning horizon through 2018. The overall goals of the WSIP for the regional water system are to:

- Maintain high-quality water;
- Reduce vulnerability to earthquakes;
- Increase water delivery reliability;
- Meet customer water supply needs;
- Enhance sustainability; and
- Achieve a cost-effective, fully operational system.

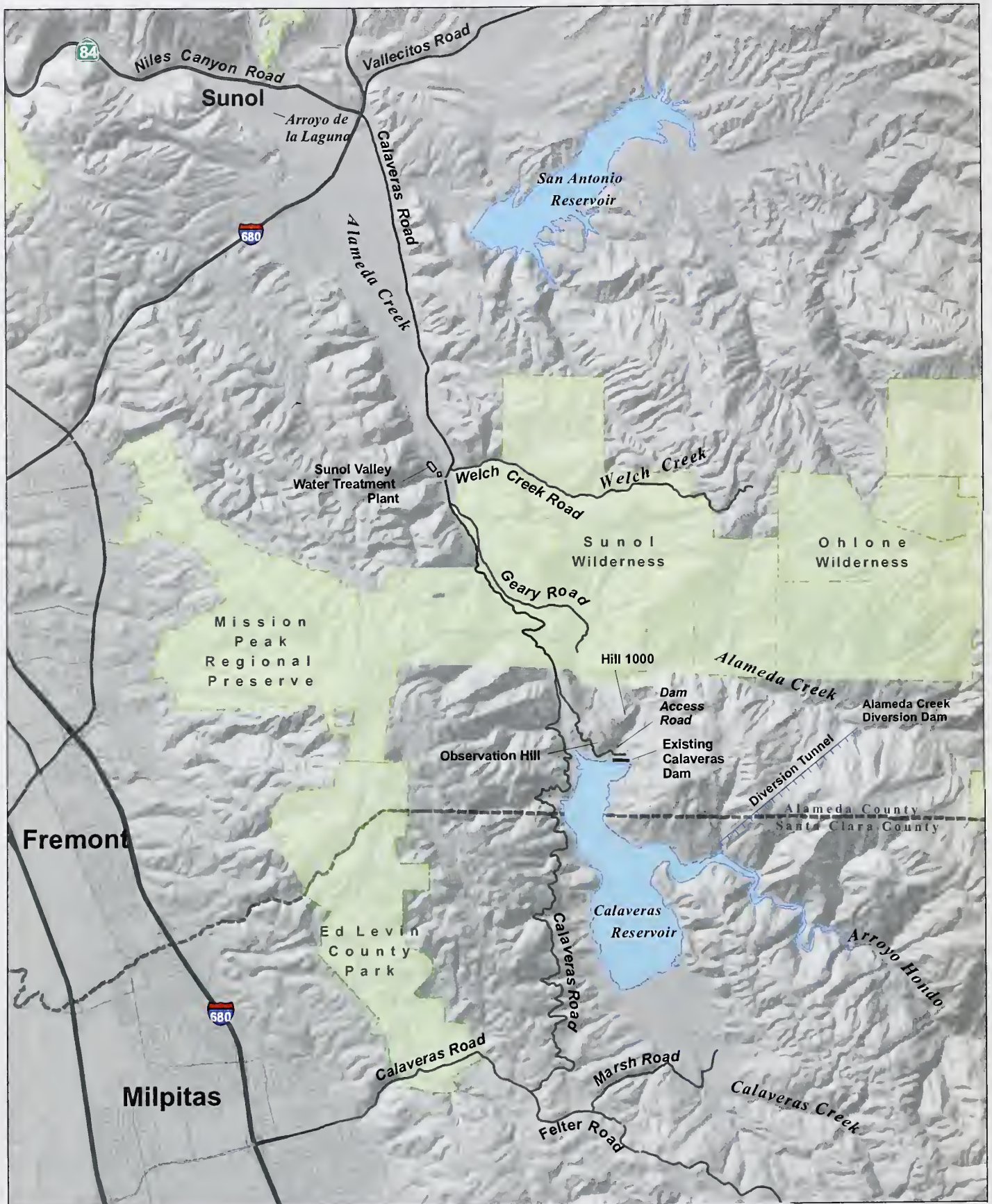
¹ Words followed by an asterisk (*) after their first use are defined in the Glossary for this EIR.



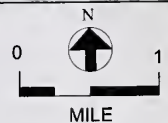
CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.1: PROJECT LOCATION
2005.0161E / Calaveras Dam Replacement Project

Public Draft EIR – October 6, 2009



SOURCE: EDAW 2008



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.2: CALAVERAS DAM VICINITY

The size and design of the individual WSIP facility improvement projects are driven by the WSIP's system performance objectives and would not change as a result of the WSIP's water supply strategy. The originally proposed WSIP included multiple program goals for improving seismic reliability and water delivery reliability, meeting current and future water quality regulations, and meeting water supply reliability goals. Design and capacity of the WSIP facility improvement projects are driven by all four of the WSIP objectives -- the need to improve system performance for seismic reliability and water delivery reliability as well as the need to maintain high water quality standards and meet water supply goals. All four of these objectives are factored into the decision on how to size the WSIP's individual facilities. Thus, even if the goal of meeting projected increases in water supply demands were dropped from the mix of program objectives, the other program goals would cause the SFPUC to design WSIP facility improvement projects of the same size. All the WSIP facilities are sized to reliably deliver an average annual amount of 265 million gallons per day (mgd) (and up to 300 mgd) while accommodating the regional system's needs for seismic and delivery reliability during both drought and non-drought periods, as well as the need to meet water quality requirements (SFPUC Resolution No. 08-0200).

3.2.1 PROJECT BACKGROUND AND PURPOSE

Calaveras Dam and Reservoir are important components of the SFPUC regional water system. Constructed between 1913 and 1925 and later modified, Calaveras Dam allows for storage of approximately 96,850 acre-feet* (AF) (31 billion gallons) of local watershed runoff in the Alameda Creek watershed. At this level of storage, Calaveras Reservoir is the largest SFPUC San Francisco Bay Area (local) reservoir, providing about 40 percent of the SFPUC's local water storage* and 66 percent of local water yield*.

The SFPUC initiated studies in 1998 to evaluate the structural stability and performance of the dam during projected large earthquakes. The studies indicated that the dam does not meet current safety standards for large earthquakes. Beginning in the winter of 2001, the SFPUC lowered water levels in the reservoir in response to safety concerns about the seismic stability of the dam and a mandate from the California Department of Water Resources, Division of Safety of Dams (DSOD). The elevation of the lowered water level corresponds to about 38,100 AF of storage, which is approximately 60 percent less than the previous nominal total water storage² (see Section 3.3, Overview of the Existing Dam and Reservoir). DSOD has indicated that it is allowing this interim operating level to accommodate a small portion of the water supply needs with the understanding that the SFPUC is pursuing an aggressive schedule to rebuild the dam in order to eliminate the seismic safety concerns associated with the original dam. For the purposes

² Total storage is the total volume of water that is stored behind the dam. The pre-DSOD restriction total storage of Calaveras Reservoir was 96,850 acre-feet. Thus, the total storage of the reservoir has been reduced by almost 60 percent.

of this Environmental Impact Report (EIR), the existing lowered water level is the assumed baseline condition to which the proposed project is compared.

The overall purpose of the proposed project is to replace the existing dam with a new dam to accommodate a public water supply reservoir of the same size as the original plans (96,850 AF³) and meet current seismic safety design requirements. When the proposed replacement dam is completed, DSOD restrictions would be lifted and the original reservoir pool* could be restored.

Completion of the proposed project would help the SFPUC achieve the WSIP Level of Service objectives for its regional water system (SFPUC 2006a). These objectives include providing high-quality water, maintaining a reliable system during earthquakes, maintaining delivery reliability, and increasing water supply to meet customer demand for SFPUC water in non-drought and drought conditions through the year 2018. Specifically, replacing Calaveras Dam and re-establishing the reservoir pool to its pre-DSOD restricted level would restore the facility's role within the SFPUC regional water system with respect to delivery reliability and water supply during planned and unplanned interruptions of the SFPUC's Hetch Hetchy System and during periods of drought, as well as enhance seismic safety, reliability, and water quality.

3.2.2 PROJECT OBJECTIVES

The Primary Objectives of the CDRP are as follows:

- Re-establish water delivery reliability;
- Restore water supply and the capacity of the reservoir to its pre-2001 restriction level of 96,850 AF using water from the Alameda Creek watershed, thereby restoring 7 million gallons per day (mgd) of water supply during the 8.5-year design drought (the SFPUC's drought planning scenario);
- Improve seismic reliability through construction of a replacement dam designed to safely retain 96,850 AF of water and withstand the maximum credible earthquake (7.25 moment magnitude*) on the Calaveras fault; and
- Construct a new dam with a robust design (wide centrally-located clay core, wide filters, and internal drainage) that could accommodate potential enlargement by future generations.

The Secondary Objectives of the proposed project are as follows:

- Continue reservoir and outlet works operation, to the extent possible, during construction; and
- Maintain high water quality, re-creating a deeper pool that would keep water temperatures cooler to limit algal growth in the reservoir.

Each of the project objectives is discussed below.

³ The storage capacity of the reservoir when it was first constructed in 1925 was 96,850 AF, and that is how it continues to be identified. Over the last 80 years, sedimentation within the reservoir from the surrounding drainages, principally Arroyo Hondo, has reduced reservoir capacity to approximately 92,000 AF, based on bathymetric* surveys by SFPUC in 2000. Thus, the nominal storage capacity is 96,850 AF.

3.2.2.1 Water Delivery Reliability

The SFPUC regional water system supplies water to about 2.4 million users in the Bay Area, with an estimated annual average-day delivery of 265 mgd in 2018. Water is supplied primarily from the Hetch Hetchy Reservoir in the Sierra Nevada Mountains and from six local reservoirs in Alameda, Santa Clara, and San Mateo Counties (Calaveras Reservoir and San Antonio Reservoir in the Sunol Region, and San Andreas Reservoir, Upper and Lower Crystal Springs Reservoirs, and Pilarcitos Reservoir in the Peninsula Region). Unlike most of the other reservoirs in the local water supply system that are filled in part from the Hetch Hetchy System Sierra Nevada source, water in the Calaveras Reservoir comes solely from the surrounding watershed. As the largest source of local water yield, Calaveras Reservoir is an important element in overall system delivery reliability, including delivery of water to customers during the winter when the Hetch Hetchy reservoirs are filling.

Calaveras Reservoir is also a prominent component in the integration of the local system and the Hetch Hetchy System. When the supply of water from the Hetch Hetchy System is interrupted due to planned and unplanned outages (for example, when there is a scheduled shutdown for system maintenance, when emergency repairs are needed, or when the Hetch Hetchy System supply temporarily does not meet water quality standards and must be removed from the system), water from the Calaveras Reservoir is used to meet customer demand. During interruptions in supply from the Hetch Hetchy System, the delivery objective for SFPUC operations in the Sunol Region is 160 mgd. SFPUC draws stored water from the San Antonio and Calaveras Reservoirs to the Sunol Valley Water Treatment Plant (SVWTP) to meet this level of average customer demand. The pipeline from Calaveras Reservoir to the SVWTP/San Antonio Reservoir can deliver a maximum of up to 90 mgd. With the DSOD-restricted maximum elevation of 705 feet⁴ (approximately 38,100 AF) and a previous California Department of Fish and Game (CDFG) established minimum lake level elevation of 690 feet (SFPUC 1991) (approximately 25,700 AF), usable storage⁵ at present is limited to 12,400 AF (4 billion gallons), a reduction of more than 75 percent from the 96,850 AF pre-DSOD restricted storage capacity. At this reduced volume, Calaveras Reservoir's current usable storage capacity can provide only a maximum of 45 consecutive days of supply to SFPUC's Bay Area customers during a Hetch Hetchy outage; it cannot meet the SFPUC's delivery reliability objective for the Sunol Region reservoirs of up to 60 consecutive days of supply. Overall system operational flexibility and reliability have also been reduced. Replacing Calaveras Dam would allow the reservoir storage to be restored to its pre-DSOD restricted capacity of 96,850 AF, and previous level of delivery reliability.

⁴ All elevations of the reservoir for this report are identified in feet above the NGVD 1929 Datum*.

⁵ Useable storage is the volume of water between the water surface and the deadpool* or other lower limit such as the CDFG minimum lake level elevation. The pre-DSOD-restriction useable storage of Calaveras Reservoir was 96,850 AF minus the volume that CDFG requires to be maintained (approximately 30,000 AF). Thus, the normal useable storage was approximately 68,850 AF. After the DSOD restriction, the useable storage was reduced to 12,400 AF, a reduction of approximately 75 percent.

3.2.2.2 Water Supply

The DSOD restriction in storage has impaired the reservoir's ability to retain local runoff for delivery to meet customer demand, resulting in a loss of supply (for example, more than an estimated 60,000 AF of inflow* had to be bypassed at the dam in 2006).

The replacement dam would re-establish the reservoir to its original nominal capacity. This would not only facilitate the water system's ability to meet average daily demand, but also would restore 7 mgd of water supply during the 8.5-year design drought (system firm yield*) used by the SFPUC for delivery planning (SFPUC 2007a). Drought protection is a key objective of the proposed project.

3.2.2.3 Seismic Safety and Reliability

Calaveras Reservoir inundates part of Calaveras Valley, which was formed in part by erosion along and displacement of the Calaveras fault over geologic time. The Calaveras fault has generated small and moderate earthquakes during the past 200 years. The major active trace of the Calaveras fault is located approximately 1,600 feet west of the dam's spillway (see Figure 4.8.1, Lithology and Geologic Features of the Project Site, in Section 4.8, Geology, Soils, and Seismicity) (Olivia Chen Consultants 2003, p. 11).

Other traces of the Calaveras fault that may be active are located approximately 900 feet west of the spillway; this group includes the Gully fault. Faults that are located close to the dam and the spillway, including the Quarry and Spillway faults, are considered inactive* (URS 2005b, p. 5-1). Detailed geologic investigations indicated that no active faults* are known to extend beneath the Calaveras Dam; thus, dam failure due to fault displacement in bedrock under the dam is not considered a seismic hazard. However, because of the type of dam construction and the close proximity of the existing dam and reservoir to the Calaveras fault, strong ground motions generated during a large earthquake on the fault could impact the stability of the existing dam (URS 2005b, p. 1-2).

In 2001, the SFPUC performed a stability evaluation of the dam and concluded that the dam would be unstable during projected strong ground motions from a large earthquake generated on the Calaveras fault or other more distant faults. As a result of this finding, DSOD ordered SFPUC to reduce the level of the reservoir to Elevation 700 feet (later revised to Elevation 705 feet in 2003) and to evaluate the seismic performance of the dam (DSOD 2001). Seismic performance was evaluated for the SFPUC in January 2003 (Olivia Chen Consultants 2003). The seismic evaluation of the dam concluded that:

- The current dam and foundation can be expected to experience damaging levels of liquefaction* in the event of a major earthquake on the adjacent Calaveras fault.
- This liquefaction will render the embankment* unstable and will result in significant displacements and deformations.
- The magnitude of these deformations is likely to be such that the post-earthquake dam crest* can be expected to settle 30 to 60 feet.
- These large displacements and settlements will produce severe cracking in the embankment materials. The cracking will result in a further reduction of the effective dam crest elevation.
- The reservoir can be safely operated with the dam in its current condition with a reservoir elevation of 704 to 714 feet.

The proposed project is intended to respond to these concerns by replacing the existing dam with a dam designed to meet current DSOD design requirements to be able to withstand the seismic forces that may occur at the site. The performance objectives for the replacement dam's design include providing outlet releases sufficient to meet DSOD emergency reservoir evacuation requirements and providing a dam that remains functional to store and supply water after a major earthquake (see Subsection 3.4.1, Design Criteria).

The Calaveras Reservoir is considered by the SFPUC to be an important source of supply following a major earthquake. The replacement dam would improve the seismic reliability of the local water system itself. In conjunction with other WSIP projects, this reservoir is anticipated to supply water following a rupture on the Calaveras, San Andreas, or Hayward faults (Parsons 2006).

3.2.2.4 Robust Design for Potential Future Enlargement

The new dam would be designed and constructed so as not to preclude potential future enlargement up to 386,000 AF of reservoir storage. The design would allow for potential future reuse of dam components without the requirement of extensive dam removal or rebuilding. The SFPUC, at this time, does not reasonably foresee the need for a larger dam beyond one that restores the reservoir's capacity to pre-DSOD restricted levels. The robust core design will allow future generations the option to enlarge the reservoir based on future demand and climate conditions. The issue of global warming/climate change has become an important factor in water resources planning in California, and it is being considered during planning for the SFPUC's regional water system. Any enlargement in the future would require a new CEQA review process and agency approvals of the new project, including, but not limited to, modification or replacement of the existing operating permit by DSOD and possible additional water rights from the State Water Resources Control Board. Potential future dam enlargement is not proposed at this time and is not included in this EIR.

3.2.2.5 Continuation of Reservoir Operation During Construction

Because of the important role of Calaveras Reservoir in the operation of the water system, particularly when Hetch Hetchy System operations are suspended or during a drought, the SFPUC must be able to draw on Calaveras Reservoir as a source of supply during the project construction period of approximately 4 years. The outlet works would be operational during all periods of construction, except during two summer construction seasons when the outlet works would be rebuilt and relocated.

3.2.2.6 Water Quality

The current baseline, with a lowered reservoir elevation, has created conditions that increase the potential for algae growth, which can lead to taste and odor problems (see Subsection 3.3.4.5, Reservoir Limnology). Although these problems have been minimized at the reservoir and by use of the hypolimnetic oxygenation system* (HOS) and treatment at the SVWTP, restoring the reservoir elevation to its pre-DSOD restricted storage level would provide for cooler water temperatures that inhibit algal growth problems and improve the quality of the water at the source.

3.3 OVERVIEW OF THE EXISTING DAM AND RESERVOIR

3.3.1 EXISTING DAM

Construction of the existing dam started in 1913. The initial design called for a central core of hydraulically-placed fill between upstream and downstream gravel and sand berms*. In 1918, when the dam was nearly complete, the upstream side of the dam failed as a result of increased pore water pressure due to the weight of the embankment that was not free-draining. The dam was reconstructed between 1923 and 1925 with weak dumped rockfill shells and a rolled clay core. A limited amount of the failed dam was excavated prior to the placement of the rockfill and clay core, leaving large amounts of failed material and hydraulic fill in place within the base of the completed dam. In 1974, the entire upstream and portions of the downstream structural shells of the dam were reinforced with a layer of rock up to 30 feet thick. Today, nearly all of the material that was left in place after the failure in 1918 is still in place below the stronger materials that were subsequently placed on the failed portions of the original structure. The source of the original construction materials included fill and rock from the surrounding Franciscan Complex.⁶

At present, Calaveras Dam is an earthfill embankment comprised of approximately 3.5 million cubic yards of material obtained from adjacent or nearby rock and soil sources. Figure 3.3:

⁶ The Franciscan Complex is characterized by a pervasively sheared* block-in-matrix fabric consisting of a dark-gray to black, clayey shale* matrix with abundant tectonic* inclusions of greywacke, serpentinite*, silicious schist*, greenstone*, and blueschist, which are known to contain naturally occurring asbestos (NOA).

Existing Facilities, shows the existing dam and spillway. The existing dam is approximately 210 feet high. The crest, at Elevation 778.6 feet, is approximately 1,200 feet long.

The existing dam's spillway, outlet works, and control valves are described below.

3.3.1.1 Spillway

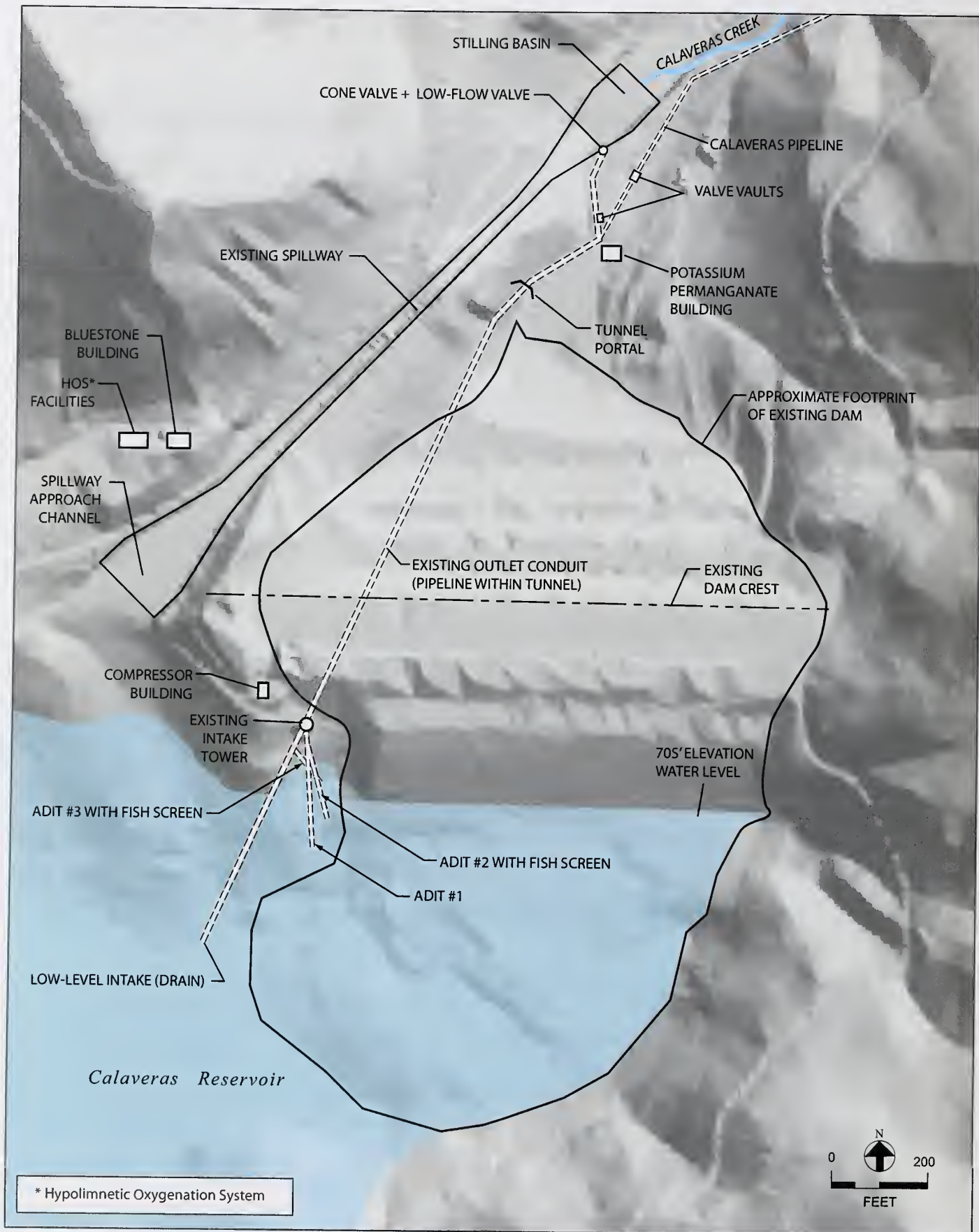
The existing concrete spillway is located immediately to the west of the dam on the left abutment*. The spillway functions as a rapid water release* control during periods of high precipitation when the reservoir level rises rapidly. The sole purpose of the spillway is to prevent the reservoir from overtopping the crest of the dam.

The spillway is capable of passing the flows of the Probable Maximum Flood* (PMF) although such an event has not yet occurred in the life of the dam. Under normal conditions, and during moderate rainfall events, the water level in the reservoir can also be controlled by releasing water through a 72-inch-diameter cone valve* (see Subsection 3.3.1.3, Control Valves). Thus, the spillway provides an additional level of protection to the dam during unusual storm events. The spillway consists of an approach channel on the upstream side with an ungated spillway crest* at Elevation 756.2 feet and, on the downstream side, a concrete-lined trapezoidal chute* terminating in a stilling basin*. The concrete-lined stilling basin helps to absorb the force of the water flowing from the spillway structure, so that the stream banks and streambed* are not scoured*. It discharges into Calaveras Creek approximately 800 feet downstream from the crest of the dam.

The spillway is 155 feet wide at its crest and narrows to 19.8 feet wide just above the stilling basin. The spillway widens at the stilling basin, becoming 100 feet wide at its downstream end. It is 1,467 feet long from the crest to the downstream end of the 100-foot-wide-by-100-foot-long stilling basin.

Calaveras Dam has spilled infrequently prior to the DSOD restrictions. Based on reservoir elevation records, the reservoir was allowed to fill and spill for prolonged periods of time, an average of about 67 days in years when spill occurred. The maximum rate of spill was approximately 5,813 cubic feet per second (cfs) on April 3, 1958. That flow over the spillway was about 12 percent of the projected flow under the PMF event.

The reservoir has not spilled since the DSOD restriction was imposed on reservoir storage in 2001, as discharges to the SVWTP and releases through the cone valve maintain the lowered reservoir level.



SOURCE: URS; EDAW&Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.3: EXISTING FACILITIES

3.3.1.2 Outlet Works

The outlet works include an intake tower, vertical shaft, and an outlet tunnel. Their function is to withdraw water from the reservoir either into a 44-inch-diameter pipeline that conveys the water to the SVWTP about 4 miles north of the dam or to the San Antonio Reservoir, or release it into Calaveras Creek. The intake tower is located in the reservoir approximately 220 feet upstream from the crest of the dam. The tower is a 12-foot-interior-diameter, reinforced concrete, free-standing structure (riser) standing on top of a vertical shaft, which is excavated in rock down to Elevation 594 feet. Intake pipes (called adits*) at three elevations and a low-level intake (drain) line run from the bottom of the reservoir through rock to the shaft. Under pre-DSOD restricted operating conditions, for water quality reasons and to minimize the potential to entrain* fish, water intake for delivery to the SVWTP has typically occurred through the upper adits. The reservoir ends of the upper two of the three adits have fish screens* (URS 2005b) to prevent fish from becoming entrained within the outlet works pipeline. The bottom of the shaft is connected to an 8-foot-diameter horizontal tunnel that extends approximately 1,006 feet beneath the dam. Within the intake shaft there is a 60-inch-diameter steel pipe (riser) with four intake valves at Elevations 602, 664, 699, and 727 feet (URS 2005b). This pipe connects to a 72-inch-diameter pipe that lies within the tunnel beneath the dam and continues 170 feet beyond the toe of the dam to a bifurcation*. One branch continues to the 72-inch-diameter fixed cone valve that discharges to the spillway stilling basin. The other branch connects to the 44-inch-diameter Calaveras Pipeline. In 1992, the shaft, tunnel, and pipeline were renovated.

3.3.1.3 Control Valves

The control valves for the outlet works are located in the intake shaft. The lowest intake valve is manually controlled at the bottom of the intake shaft. Controls for the other intake valves are electronic and can be operated either from the top of the intake shaft or from the SVWTP using the SFPUC's Supervisory Control and Data Acquisition (SCADA) remote computerized operations system. The outlet works are normally operated with downstream control. One or more intake valves are left in a fully open position, thereby filling the riser, the 72-inch-diameter pipe in the tunnel under the dam, and the Calaveras Pipeline. Discharge is controlled at the downstream end, by partially opening valves discharging to the SVWTP and/or Calaveras Creek. In addition to the upstream and downstream valves, there are isolation valves at the bifurcation so that the one operating branch can be isolated and dewatered while the other branch continues to operate.

There are two controls for the cone valve: a guard valve and the cone valve itself. Controls for both valves are electronic and are at the valve locations near the spillway. They can also be controlled through SCADA, although this is not standard operating procedure.

In 2006, SFPUC installed a temporary 12-inch low-flow release valve adjacent to the existing cone valve to accommodate flows for studies of fisheries and other aquatic resources. The existing 72-inch cone valve is designed for rapid evacuation of water from the reservoir. It provides only high-volume releases, with little provision for small adjustments in flow (the flow range of the cone valve is between 130 and approximately 870 cfs depending on reservoir level and the flow range of the low-flow valve is between 5 and 25 cfs). The low-flow valve allows flow conditions that better approach the natural hydrology* of Calaveras Creek (downstream of Calaveras Dam) and Alameda Creek (see Subsection 3.3.4.2, Spillway and Valve Releases, for further discussion).

3.3.2 EXISTING RESERVOIR

3.3.2.1 Drainage Area and Storage Capacity

Figure 3.4: Calaveras Dam Watershed, shows the drainage area upstream of Calaveras Dam. Calaveras Dam collects water from the Calaveras Creek and Arroyo Hondo drainage basins* and upper Alameda Creek. The combined drainage area of the Calaveras Creek and Arroyo Hondo watersheds is approximately 98 square miles. Calaveras Reservoir impounds all the flows from Calaveras Creek and Arroyo Hondo watersheds. It also collects water from the upper Alameda Creek watershed by means of the Alameda Creek Diversion Dam (ACDD) on upper Alameda Creek and conveyance in a 1.8-mile-long tunnel. The portion of the upper Alameda Creek drainage basin above the diversion point is approximately 34 square miles. Thus, the total drainage area of the reservoir from all three watersheds is approximately 132 square miles.

Prior to 2002, in a typical year, Alameda Creek contributed most of its flow (approximately 6,000 AF, representing 14 percent of the 42,000 acre-feet per year (AFY) combined inflow) to Calaveras Reservoir (URS 2005b, pp. B-1 to B-2). Because of the DSOD-restricted water level in Calaveras Reservoir, the ability to divert water from upper Alameda Creek through the diversion tunnel for storage in Calaveras Reservoir has been reduced. The SFPUC has operated the diversion dam on a limited basis since the DSOD restriction on reservoir elevation was put into effect in 2001.

As designed, the storage capacity of the Calaveras Reservoir at nominal pool Elevation 756 feet was approximately 96,850 AF. In 2001, DSOD limited the maximum reservoir level to Elevation 700 feet. In 2003, DSOD allowed its previously imposed limit on the elevation of the reservoir to be raised to 705 feet (DSOD 2003). Water levels may briefly rise above Elevation 705 feet following large storms (like those in spring 2006), but the SFPUC must remove water from the reservoir as quickly as possible to return the pool to Elevation 705 feet. At this level, the existing Calaveras Reservoir stores approximately 38,100 AF of water. This is the identified baseline for the environmental analyses in this EIR.



SOURCE: ESA + Orion; USGS

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.4: CALAVERAS DAM WATERSHED

In accordance with a 1991 Memorandum of Understanding (MOU) with CDFG, the SFPUC maintains a minimum pool elevation of 690 feet (approximately 30,000 AF) to minimize the potential for entrainment of fish into the intake (SFPUC 1991). During a drought or water supply emergency, the reservoir is allowed to be drawn down further.

The surface area of Calaveras Reservoir at the design elevation of 756 feet is approximately 1,465 acres. At the current restricted pool elevation of 705 feet, the surface area of the reservoir is approximately 860 acres. At design elevation of 756 feet, the reservoir is approximately 3.2 miles long and 1.0 mile wide. At the currently reduced elevation of 705 feet, the reservoir is approximately 2.2 miles long and 0.8 mile wide. The depth of the reservoir varies seasonally as runoff is received and as discharges are made for water supply and the maintenance of a safe reservoir level. At the design elevation of 756 feet, the depth at the deepest point is approximately 135 feet. At the current restricted surface elevation of 705 feet, the depth at the deepest point of the reservoir is approximately 85 feet.

Sediment is carried into the reservoir with runoff and, having no outlet, is deposited in the reservoir. Over the last 80 years, sedimentation has reduced reservoir storage capacity by approximately 4,850 AF (URS 2005b, p. 1-2). The depth of the sediment varies within the reservoir.

3.3.2.2 Water Quality

Title 22 of the California Code of Regulations requires that all purveyors of drinking water from surface water sources conduct a watershed sanitary survey of their systems and update it every 5 years. In April 2006, the SFPUC provided its most recent water quality findings. Major monitoring programs for Calaveras Reservoir include microbiology, annual monitoring of numerous constituents regulated under the Safe Drinking Water Act, reservoir limnology* and conventional water quality. Water quality data collected in the 2001 to 2005 time period as part of the SFPUC Watershed Sanitary Survey indicate that the water in Calaveras Reservoir was of excellent quality and consistently met regulatory standards (SFPUC 2006b, p. ES-9). However, at the current restricted pool elevation of 705 feet, conditions favoring the growth of undesirable algae are enhanced. Increased algal content in the water has caused taste and odor problems (see the discussion in Subsection 3.3.4.5, Reservoir Limnology).

Reservoir water has been monitored for the presence of any residual chemicals from a former use at the south end of the reservoir, the Calaveras Test Site. Prior to 1993, the City and County of San Francisco leased the Calaveras Test Site, first to Stanford Research Institute for chemical research, and then to an ordnance device manufacturing company. These uses resulted in releases of chemicals to soil and groundwater* at the site. The site has been monitored since 1994; analyses of samples taken from Calaveras Reservoir have not detected the presence of any of the residual chemicals released at the site in the reservoir water. (See Sections 3.5.1.4, Sources of

Material for Construction, and 4.9, Hazards and Hazardous Materials, for a discussion of the Calaveras Test Site.)

In addition to monitoring, the SFPUC protects water quality by restricting public access to the reservoir and to the watershed. Recreational uses, such as boating, fishing, and swimming, are not allowed in the reservoir or on watershed lands managed by the SFPUC. In October 2006, the SFPUC began installing fencing along adjacent riparian* areas to limit livestock and wild animal access to protect and improve water quality and aquatic habitat structure and quality. Installation of the fencing is expected to be completed by 2009.

3.3.3 OTHER EXISTING STRUCTURES

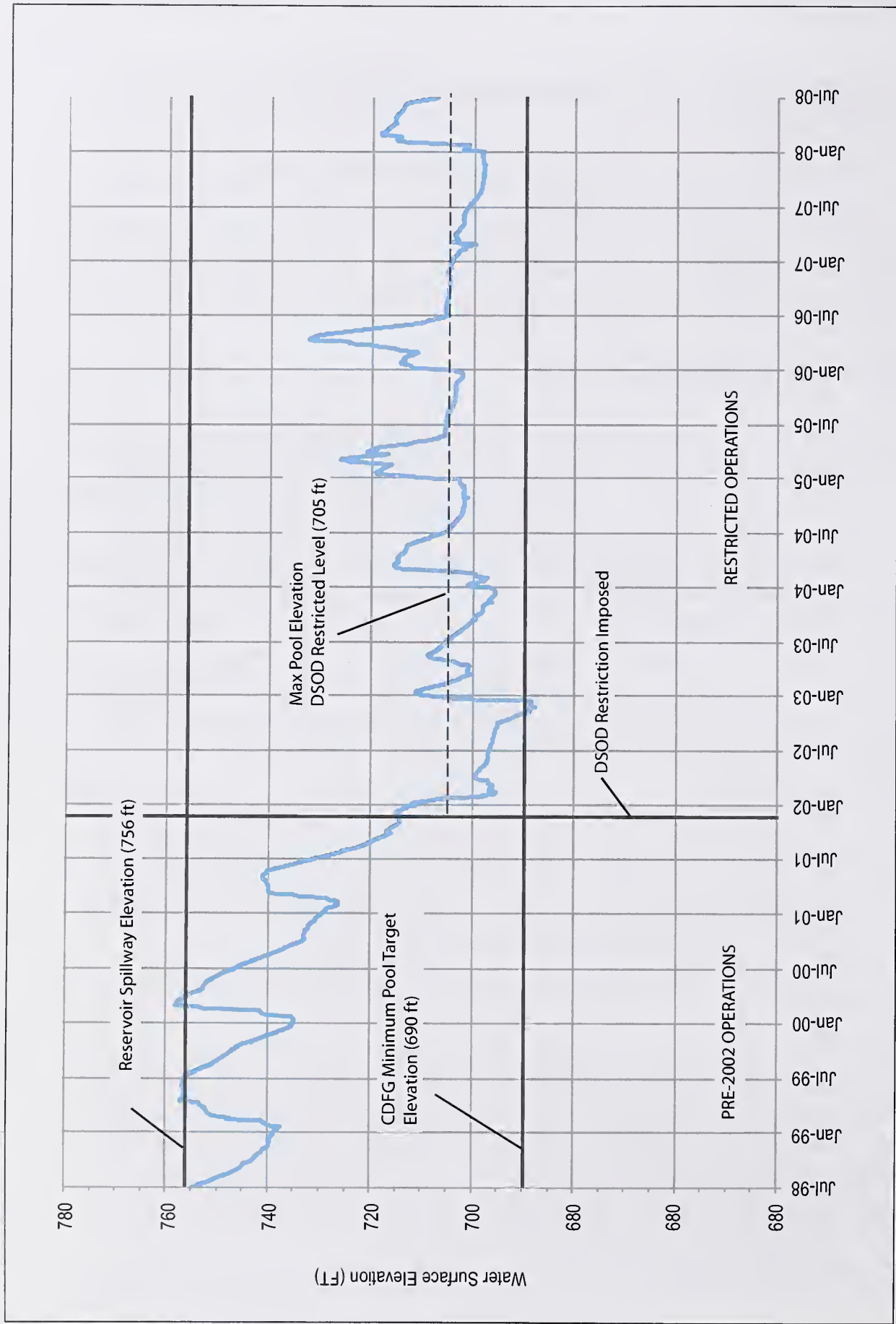
There are several structures near the dam that are used to support maintenance and operation of the dam and reservoir (see Figure 3.3, Existing Facilities). The watershed keeper's residence, consisting of the watershed keeper's residence and associated outbuildings, is located on a terrace on the east shore of the reservoir just south of the existing dam. The potassium permanganate storage building, which is located downstream of the dam, is used for storage of bulk potassium permanganate used for water treatment. The warehouse/compressor building, located in the parking lot near the existing intake tower and shaft, is used for storage of equipment that is not currently being used. The bluestone building and the HOS facilities are located on a road adjacent to the existing spillway crest. The bluestone building is used for storage of bulk copper sulfate used for water quality treatment. (Potassium permanganate treatment and the HOS are described in Subsection 3.3.4.6, On-Site Water Treatment.)

3.3.4 OPERATION

The SFPUC has historically operated Calaveras Reservoir to meet the following objectives:

- Maximize storage within the reservoir to meet potential drought and water supply needs;
- Maximize conservation of runoff on a long-term basis; and
- Meet short-term water supply operational requirements, e.g., Hetch Hetchy System interruptions.

Prior to the implementation of the DSOD order to lower the reservoir level, in normal or wet years the reservoir would normally be allowed to fill during the rainy season (approximately mid-October through mid-April) and would be drawn down 15,000 to 20,000 AF during the summer and fall in order to create capacity to capture winter runoff (see Figure 3.5: Existing Annual Recharge – Drawdown Cycle of Calaveras Reservoir). During a drought or water supply emergency, the reservoir would be drawn down further to meet water supply needs. The reservoir would also be drawn down for scheduled maintenance.



SOURCE: SFPUC, ED&W&Turnison, JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.5: EXISTING ANNUAL RECHARGE-DRAWDOWN CYCLE OF CALAVERAS RESERVOIR

Under the terms of the 1991 MOU with CDFG, the SFPUC has been maintaining a pool elevation of at least 690 feet to prevent entrainment of the resident fish population in the reservoir. Thus, under the DSOD restriction conditions, the reservoir level fluctuates for short periods, sometimes higher than Elevation 705 feet and sometimes lower. In general, the reservoir level is nominally at Elevation 705 feet, but does not drop lower than the minimum elevation of about 690 feet.

3.3.4.1 Water Supply Withdrawals

Water supply withdrawals from Calaveras Reservoir flow into the Calaveras Pipeline and then either to the SVWTP or to San Antonio Reservoir for storage. The amount of water that SFPUC discharges per year from Calaveras Reservoir for water supply purposes varies substantially.

From 1996 to 2005, annual withdrawals to the Calaveras Pipeline ranged from 9,870 AF to 43,660 AF. The withdrawals were not continuous, but there has not been any typical pattern. The flow variation is related to many factors ranging from maintenance at the dam to maintenance at the SVWTP, as well as weather conditions and reservoir water quality. The flows range from 0 to approximately 90 mgd, the nominal capacity of the Calaveras Pipeline.

Withdrawals from the reservoir for water supply are greatest from fall through spring and least after the rainy season at the end of spring or early summer. This schedule of withdrawals allows SFPUC to maximize the amount of water available in Calaveras Reservoir in the event of a partial or total disruption of the Hetch Hetchy Reservoir water supply, for drought protection, and for supply during maintenance periods. In the fall, the reservoir is drawn down as necessary to provide capacity to capture winter runoff.

When making a withdrawal either to the Calaveras Pipeline or the cone valve, the operators at the SVWTP select which intake valves to open based on the amount of flow required, the level of the water in the reservoir, seasonal CDFG requirements regarding the water approach velocity at the intake screens, and water quality considerations such as the presence of algae and the dissolved oxygen (DO) concentration at the intake valve depths. Normally the valves are operated electronically at the intake shaft (they can also be operated from the SVWTP using SCADA). The appropriate numbers of adit valves are opened to allow for the amount of flow desired. The intake valves are opened first, then the isolation valve to either the Calaveras Pipeline or the cone valve, and finally, if the release is to the cone valve, the cone valve is opened incrementally until the desired flow is achieved.

3.3.4.2 Spillway and Valve Releases

As discussed in Subsection 3.3.1.1, Spillway, there have been no spillway releases since December 2001. This is because the spillway crest is at Elevation 756 feet and the reservoir has been operated to comply with the DSOD restriction that reduces the level of the reservoir to

Elevation 705 feet. Following periods of heavy inflow, reservoir storage rises temporarily while the SFPUC lowers the level by releasing water to the SVWTP and occasionally by discharging water through the cone valve to the stilling basin and from there into Calaveras Creek. As described in Subsection 3.3.1.3, Control Valves, a low-flow valve is also available for environmental releases.

Releases through the cone valve are made to lower the reservoir water elevation and for dam safety compliance demonstration tests. Releases through the cone valve vary in duration depending on the reservoir level. Normal practice is to open the cone valve in anticipation of a spill. Once begun, releases through the cone valve typically continue for several weeks.

In response to the DSOD requirement to lower the reservoir elevation to 705 feet, the SFPUC released approximately 37,385 AF of water to Calaveras Creek through the cone valve between December 2001 and February 2002. The SFPUC released water through the cone valve two more times during the CEQA baseline period to maintain the reservoir at the DSOD restricted level, releasing approximately 33,574 AF from March 2005 through May 2005 and 65,402 AF from March 2006 through June 2006. Water has not been released through the cone valve since July 2006.

Prior to releasing water from the reservoir to Calaveras Creek, the SFPUC provides notification to the Alameda County Water District, Alameda County Flood Control and Water Conservation District (ACFCWCD), Alameda County Sheriff, Alameda County Office of Emergency Services, Caltrans, California Highway Patrol, East Bay Regional Park District (EBRPD), SFPUC Natural Resources, and PG&E. Responses from these agencies are considered before water is released. If an emergency release is required, the maximum release rate can be reached within 4 hours. In this event, emergency notifications are issued. In an emergency, the flow can be reduced and stopped in less than 1 hour.

Under the terms of a 1997 Memorandum of Understanding (1997 MOU) with CDFG (CDFG 1997) (see Appendix H), the SFPUC committed to release up to 6,300 AFY to Calaveras Creek for the enhancement of fisheries* and other natural resources. However, the 2001 DSOD limitation on reservoir elevation has substantially reduced usable storage (see Subsection 3.2.2, Project Objectives) and limited the available cold-water pool in the reservoir. Under current conditions, water inflow to the reservoir in excess of DSOD restrictions is periodically bypassed at Calaveras Dam and the ACDD to Calaveras Creek and Alameda Creek, respectively. The remaining allowable storage has been used for water supply purposes only. As described in Subsection 3.3.1.3, Control Valves, a low-flow valve was installed in 2006. This valve has been used for studies related to environmental releases. Releases in support of 1997 MOU requirements, as part of the proposed project, are discussed in Subsection 3.6.5, Resident Rainbow Trout Flow Releases.

3.3.4.3 Alameda Creek Diversion

The ACDD, on upper Alameda Creek, and its associated tunnel to Calaveras Reservoir were constructed between 1925 and 1931 as part of the original plan of development for Calaveras Reservoir to increase the reservoir's water supply. The diversion of flow from upper Alameda Creek to Calaveras Reservoir via the diversion dam and tunnel begins concurrently with the start of the rainy season. Two 5-foot-wide-by-8-foot-high gates control flow into the tunnel. These gates are operated manually; there is no electrical power at the diversion dam site. Flow through the tunnel is entirely by gravity. Diversion continues until the end of the rainy season. The diversion gates* may be closed earlier depending on the weather forecast, rate of inflow from Arroyo Hondo and Calaveras Creek into Calaveras Reservoir, rate of rise in Calaveras Reservoir water level, and the rate of outflow* via the Calaveras Pipeline to the SVWTP/San Antonio Reservoir. Since implementation of the DSOD storage restriction on Calaveras Reservoir, the length of the diversion period has been substantially reduced in some years depending on rain year conditions and demand (see "Post-DSOD Operations of the Alameda Creek Diversion Dam" in Section 4.6, Hydrology, for further discussion). When not diverted, high flows may occur in upper Alameda Creek during the rainy season.

Prior to the DSOD restriction in 2001, during periods of diversion to Calaveras Reservoir all, inflow up to the capacity of the diversion tunnel (approximately 650 cfs) was diverted to the reservoir; any flow in excess of 650 cfs flowed over the diversion dam. The design of the diversion dam makes it difficult to provide a bypass flow* while flow is being diverted unless the flow exceeds the capacity of the diversion tunnel.

A sluicing* procedure is performed each February whereby sluice gates in the ACDD are opened for 48 hours to flush sediment from the upstream side of the dam. The gates are opened to produce a rate of flow of approximately 50 cfs. Approximately 900 cubic yards of sediments are flushed downstream. This sluicing procedure normally takes place whether or not any diversion of flows from the creek to the diversion tunnel is taking place. The sluice gates always remain closed except during the sluicing procedure. As the gates are not designed for the purpose of water releases; there is no bypassing of flows through the sluice gates. If Alameda Creek water flow exceeds the capacity of the diversion tunnel to Calaveras Reservoir or if the diversion gates are closed, the water simply flows over the top of the diversion dam and continues downstream.

3.3.4.4 Operating Staff

Calaveras Reservoir, the ACDD, and associated facilities are managed and operated by the Water Supply and Treatment Division of the SFPUC. The surrounding watershed lands are managed by the Natural Resources and Lands Division of the SFPUC.

Minimal staff is needed to operate the dam and reservoir. A watershed keeper lives at the reservoir site and provides security and observation. Operation of the valves controlling

withdrawals to SVWTP is performed remotely using SCADA from the SVWTP. Other operations (cone valve releases and manual valve operations) are done by a crew dispatched from the SFPUC Sunol Maintenance Yard. Calaveras Dam is checked at least once a day. Data from the water quality analyzers and the potassium permanganate application system (see Subsection 3.3.4.6, On-Site Water Treatment) are checked daily by the staff.

3.3.4.5 Reservoir Limnology

Large reservoirs such as Calaveras typically undergo seasonal changes in their temperature, circulation, DO concentration, and rate of algae growth. As the air temperatures in the summer grow warmer, the surface waters of the reservoir become warmer. As the water warms, it becomes less dense and floats upward on top of cooler water. The cooler (more dense) water remains at the bottom of the reservoir as the density difference prevents mixing. Thus, the water nearer the surface becomes relatively warmer. This condition is known as stratification* and occurs in lakes deeper than about 50 feet.

When the reservoir becomes thermally stratified, it also becomes stratified in nutrient and DO concentrations. Organic matter that sinks to the bottom decomposes, releasing nutrients. The decomposition process uses oxygen that is not replenished. Thus, the nutrient concentration in the bottom layer of water becomes relatively high while the DO concentration becomes relatively low. This stratification remains quite stable until a seasonal change occurs, such as reduction in ambient temperatures sufficient to cool the surface layers of the reservoir to allow mixing. Other factors causing turnover of reservoir waters may include a high volume of inflow from runoff or strong winds, both of which can contribute to the breakdown of the water temperature stratification in the reservoir. Waters from the upper and lower layers (epilimnion* and hypolimnion,* respectively) become mixed (also termed “lake turnover”), causing nutrients and DO to become more uniformly distributed.

In Calaveras Reservoir, stratification begins in late spring after the rainy season ends (and therefore reservoir inflows are reduced) and warmer weather begins. Reservoir stratification typically lasts for approximately 8 months. The reservoir becomes de-stratified in mid-winter during the period of high runoff from the watershed and diversions into the reservoir from the ACDD.

When Calaveras Reservoir is stratified in the summer and early fall, algae grows rapidly in the warm surface waters. The presence of algae causes taste and odor problems in the water. In the bottom waters, DO is low. Low DO allows metals (iron and manganese, which are naturally present in the sediment) to be dissolved into the reservoir water. Both of these conditions affect the ability to treat the water at the SVWTP. These water quality conditions (low DO, iron, and manganese) have been exacerbated since the reservoir water elevation was lowered, as it is necessary to release water from the lower levels of the reservoir.

3.3.4.6 On-Site Water Treatment

Water discharged from Calaveras Reservoir for delivery to the SVWTP is pretreated with potassium permanganate. Potassium permanganate is used to oxidize organic material in the raw water. It helps control taste and odor and lessens the chlorine demand at the SVWTP, lessening, in turn, by-products from the disinfection* process. The potassium permanganate is injected into the Calaveras Pipeline just downstream of the bifurcation. The potassium permanganate facility consists of a concrete slab with a metal-paneled building containing chemical feed equipment and storage. Potassium permanganate is normally stored in the operations building on site; however, it may also be stored in the warehouse above the dam near the HOS facility. Up to 16,500 pounds of potassium permanganate is stored at the site.

The SFPUC operates the HOS to improve the DO level in the deeper portions of the reservoir. When the DO concentration in the deeper parts of the reservoir becomes very low, oxygen is introduced to prevent metals from becoming dissolved. The increased oxygen level is also beneficial to the fish populations in the reservoir. Up to 11,000 pounds of liquid oxygen is stored at the HOS facility. Facilities include a storage tank, metering equipment, and several thousand feet of piping. The piping consists of two bubbler tubes that extend from the dam approximately 1,500 feet and 6,500 feet into the reservoir. The DO system is usually put into operation in May (before stratification of the reservoir caused by summer warming begins) and continues to operate until fall.

To control the growth of algae in the reservoir, the SFPUC currently uses sodium percarbonate (an algaecide that releases hydrogen peroxide into the water to kill algae). Sodium percarbonate has been approved by the U.S. Environmental Protection Agency (USEPA) and the State Water Resources Control Board (SWRCB), and has been reviewed and approved for use in drinking water reservoirs by the National Sanitary Foundation. When treatment through application of sodium percarbonate is ineffective in controlling algae growth, the SFPUC uses copper-based algaecides as a secondary tool, including copper sulfate. Approximately 40,000 pounds of copper sulfate is stored in the bluestone building near the HOS facility. From 1987 to 2005, the annual use of copper sulfate ranged from 0 to approximately 37,000 pounds.

3.4 PROPOSED PROJECT ELEMENTS

The main elements of the proposed project are as follows:

- Construct a new earth and rockfill dam with a robust design (wide centrally-located clay core, wide filters, and internal drainage) that could accommodate potential enlargement by future generations, and modification (regrading) of the existing dam to accommodate the construction and operation of the new replacement dam;
- Remove the existing spillway and construct an ungated spillway with a concrete-lined channel and a new stilling basin;

- Remove the existing intake tower, plug the shaft, and construct a new intake tower and shaft connecting to an existing drain and three water inlet adits;
- Extend the outlet pipe connecting to a relocated, fixed cone valve, and install new low-flow discharge valves for fishery releases;
- Install instrumentation such as piezometers*, inclinometers, settlement monuments*, seepage weirs*, and accelerometers* to measure strong ground motions during earthquakes;
- Stabilize the right abutment* landslide; and
- Construct a bypass tunnel, with a gate to control bypass flows, through the Alameda Creek Diversion Dam.

Each of these elements is discussed below, following an overview of the design criteria for the replacement dam.

3.4.1 DESIGN CRITERIA

Calaveras Dam is under the jurisdiction of DSOD. The performance objectives that would be incorporated into the design of the replacement dam are as follows:

- Freeboard* and spillway capacity would be designed for an inflow design flood based on the Probable Maximum Precipitation⁷ (PMP) event.
- Outlet releases would be sufficient to meet DSOD emergency reservoir evacuation requirements (described below).
- The dam and related works would remain functional after the design earthquake (described in Section 3.2.2, Project Objectives). This requires that the safety of the dam embankment itself not be impaired by 1) extensive cracking, 2) crest settlement that would impair freeboard, and 3) excessive deformation in critical zones such as filters and drains. It also requires that the outlet works and spillway remain intact and operational (URS 2005b, p. 3-2).

DSOD guidelines for flood design (DSOD 1989) require that reservoir spillways have adequate capacity to pass the PMF event resulting from a PMP storm event while maintaining adequate freeboard on the dam. DSOD estimated the PMP for the Calaveras Reservoir watershed as 28.4 inches of rainfall in a 72-hour period (URS 2005b). Using U.S. Department of Commerce updated guidelines, the *Final Conceptual Engineering Report* estimated the PMP to be 30.8 inches in a 72-hour period (URS 2005b, p. 3-4). The PMF that would result from this PMP was calculated to be 49,521 cfs. This inflow would result in a PMF surcharge* at the spillway of 12.6 feet (URS 2007a, p. 5-1).

⁷ Probable Maximum Precipitation is the amount of precipitation that is the statistical (physical) upper limit for a given duration over a particular basin (United Nations 2007).

The DSOD requires that dams be provided with outlet facilities with sufficient capacity to evacuate the reservoir quickly, should an unsafe condition develop at the dam. DSOD guidelines for the emergency drawdown* rate for large reservoirs are based on having the capability to:

- Lower the reservoir elevation by an amount equal to 10 percent of the hydraulic head* behind the dam within 10 days. Hydraulic head is defined as the difference between the normal maximum water surface and deadpool surface; and
- Evacuate the reservoir to deadpool elevation within 120 days.

The SFPUC has undertaken seismic studies to evaluate fault rupture potential (URS 2005b, p. 1-3) in the vicinity of the dam site and to characterize seismically induced ground motions at the site (URS 2005b, p. 1-3) for conceptual design of dam repair and dam replacement alternatives. These studies have been conducted under the independent advisement and review by the Calaveras Technical Advisory Panel (CTAP) comprised of recognized experts in dam engineering design. (The CTAP is further discussed in Subsection 4.8.2.2, Approach to Analysis, in Section 4.8, Geology, Soils, and Seismicity.) The design of the proposed dam would meet the hydrologic, seismic and geologic design requirements in the following ways:

- The proposed dam would be located to avoid faults that are considered active or conditionally active based on DSOD guidelines;
- As required by DSOD, the design of the proposed dam would accommodate the kinds of movements and deformation that could occur under Maximum Credible Earthquake (MCE) seismic loading conditions;⁸ and
- Additionally, the design would ensure that the dam foundation is stable in relation to bedrock conditions; control landslide hazard to the dam at the right abutment; and ensure that the spillway can safely handle design flows, without compromising the stability of the structure or causing damage to Calaveras Creek.

3.4.2 DESIGN AND COMPOSITION OF THE REPLACEMENT DAM

The replacement dam would be located immediately downstream at the toe of the existing dam. The new dam would have a nominal reservoir storage of 96,850 AF. This storage is the same as the storage capacity of the reservoir when it was completed in 1925. The new dam would be designed so as not to preclude potential enlargement up to 386,000 AF of reservoir storage through a design that would allow potential future reuse of dam components without requiring extensive dam removal and rebuilding.⁹

⁸ The MCE is a moment magnitude (M) 7.25 earthquake on the central Calaveras fault at a distance of 0.5 km (0.3 mile) from the dam site.

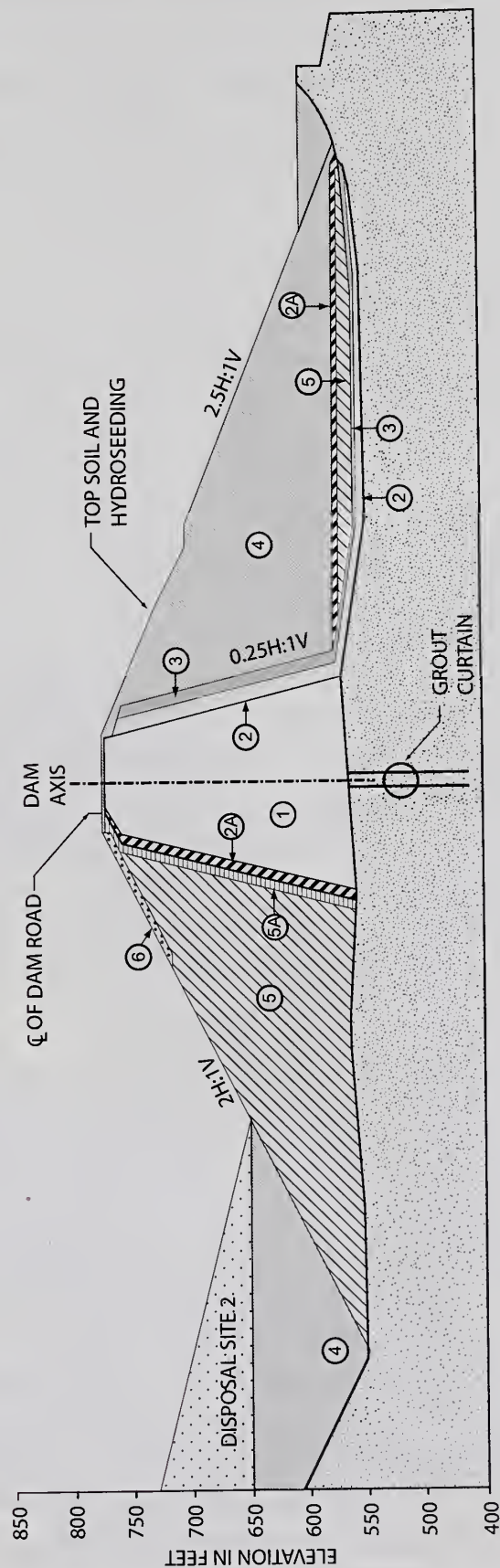
⁹ SFPUC does not reasonably foresee a need for a larger dam beyond one that restores the reservoir's historic capacity. Any enlargement in the future would require a new CEQA review process and agency approvals of the new project, including, but not limited to, modification or replacement of the existing operating permit by DSOD and possible additional water rights from the State Water Resources Control Board.

As shown in Figure 3.6: Proposed Dam Cross-Section, the dam would be approximately 220 feet high (measured from the bottom of the foundation) and 210 feet above the downstream streambed*. Freeboard would be 15.8 feet (URS 2007a, p. 5-1). The dam crest elevation would be 772 feet (URS 2007a, p. 5-1). The dam footprint would have an area of about 18 acres (URS 2005a, p. 3-4) and the dam would be 1,210 feet long at the crest, 1,180 feet thick at the base, and 80 feet thick at the crest. The total volume of the dam would be approximately 2.77 million cubic yards (URS 2008c). As shown in Figure 3.6, the dam would consist of six zones. The core of the dam (Zone 1) would be constructed of approximately 755,000 cubic yards of clay (URS 2008c). Table 3.1 compares the characteristics of the existing dam to those of the proposed replacement dam.

An earth and rockfill dam is not an impervious structure. Typically, water seeps into the dam through the tiny spaces between the particles of soil and rock. In order to protect the dam from being eroded from within by water seeping through it, filters and drains must be provided so that water can escape. Filters (Zones 2A and 5A) would be constructed between the upstream side of the core and the upstream rockfill; filter (Zone 2) and drain (Zone 3) between the downstream side of the core and the downstream shell zone; and filters (Zones 2, 2A, and 5A) and drain (Zone 3) between the downstream shell and bedrock foundation. The filter and drain zones would comprise about 352,000 cubic yards of material (URS 2008c). In addition, a grout* curtain would be constructed in bedrock directly underneath the core of the dam.

The upstream shell of the dam would be constructed of rockfill (Zone 5). The downstream shell of the dam would be constructed using Temblor Sandstone (Zone 4). The shells would consist of approximately 874,000 cubic yards of Temblor Sandstone material and 770,000 cubic yards of rockfill (URS 2008c). The upstream face of the dam that is in contact with the reservoir would be protected from erosion by a 3-foot-thick layer of riprap* (Zone 6). The riprap layer would consist of about 20,600 cubic yards of material (URS 2008c). The downstream face of the dam would be covered with topsoil and hydroseeded*. The dam would include a berm located at the downstream toe. The berm would be constructed using Temblor Sandstone compacted to the same requirements as the downstream shell (Zone 4) of the embankment.

While some materials would be salvaged from the existing dam, no part of the existing dam structure would be retained as part of the proposed replacement dam. The only parts of the existing facilities that would be retained and used would be from the outlet works: the intake adits, the drain pipe, and the portion of the outlet pipe that runs beneath the existing dam.



- (1) CORE
- (2) DOWNSTREAM FILTER
- (2A) BROAD-GRADED FILTER
- (3) DRAIN
- (4) EARTHFILL SHELL
- (5) ROCKFILL SHELL
- (5A) COARSE FILTER
- (6) RIPRAP

SOURCE: URS, EDAW & Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.6: PROPOSED DAM CROSS-SECTION

Table 3.1: Comparison of the Existing Dam with the Proposed Replacement Dam

Dam Characteristic	Existing Dam	Replacement Dam
Type of Construction	Earthfill, part hydraulic sluiced, clay core	Earth and rockfill with clay core
Volume	3.461 million cubic yards	2.772 million cubic yards
Height - Toe to Dam Crest	210 feet	210 feet
Crest Elevation ¹	778.6 feet	772 feet
Crest Length	1,200 feet	1,210 feet
Freeboard - Spillway Crest to Top of Dam	22.4 feet	15.8 feet
Footprint	18 acres	18 acres
Width at Base	1,510 feet	1,180 feet
Width at Crest	80 feet	80 feet
Minimum Reservoir Level ² (elevation ¹)	690 feet	690 feet
<i>Notes:</i>		
¹ Elevation relative to NGVD29 datum.		
² As identified in the 1991 MOU. The lowest intake is 602 feet (elevation).		

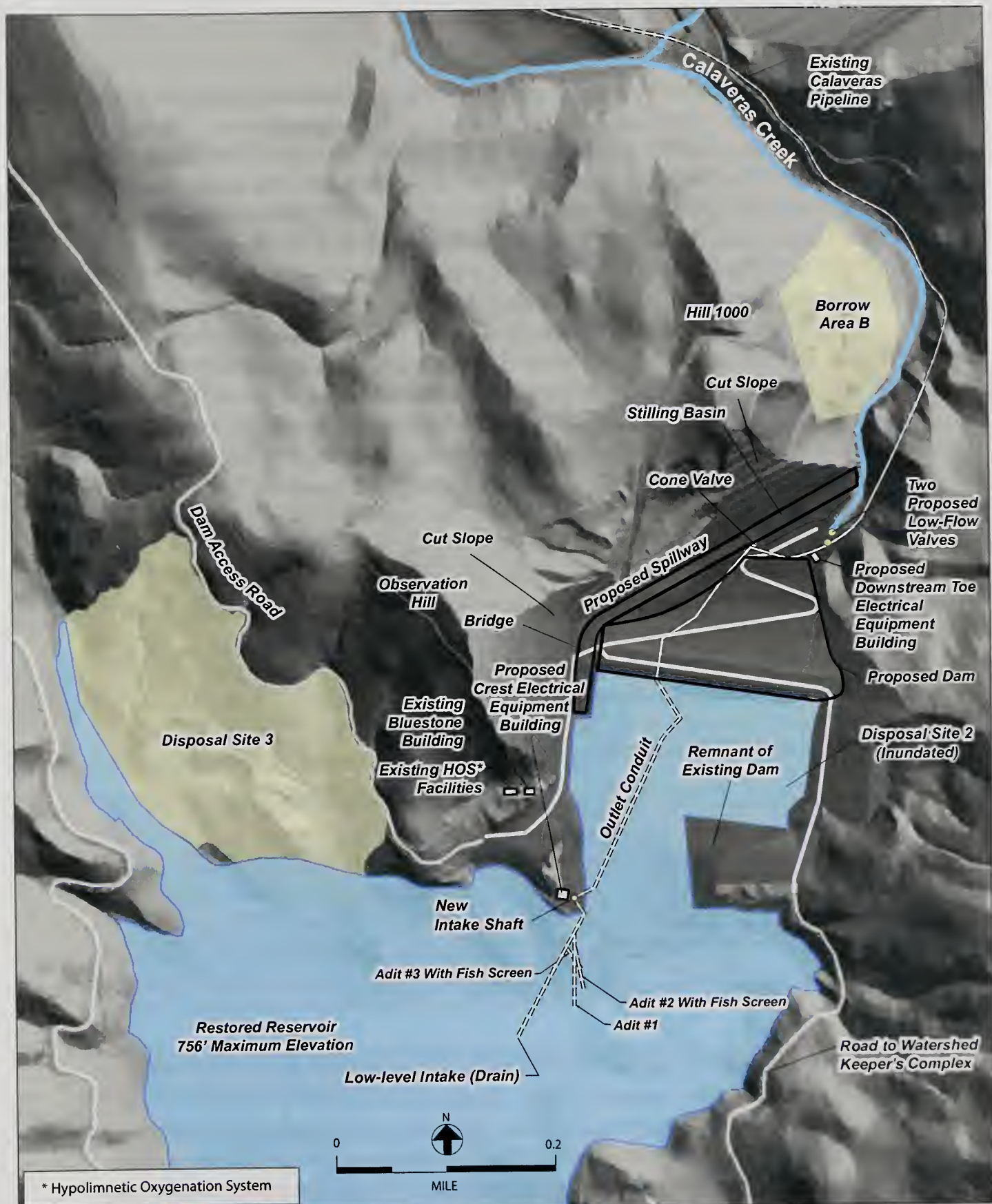
Sources: For the existing dam data: URS 2005b, p. 2-4; for the replacement dam data: URS 2006b, p. 2-1, URS 2007a, and URS 2008c

With the proposed design, the dam would be expected to remain stable and functional following a major earthquake on the Calaveras fault or regional earthquakes generated on other faults (e.g., the San Andreas fault and Hayward fault). As such, the Calaveras replacement dam would meet the DSOD requirements, and the reservoir would be restored to its pre-DSOD restricted storage and water level.

Figure 3.7, Proposed Plan of Dam Area, shows the locations of the new dam, spillway, and associated facilities.

3.4.2.1 Spillway

The following summary description of the proposed spillway is based on information provided in Spillway Model Test by URS Corporation (URS 2007a). As shown in Figure 3.7, the new spillway would be located at the western end (left abutment) of the dam. The new spillway would have a longer crest than the existing spillway, and as a result, the replacement dam crest would be lowered 6.6 feet compared to the existing dam. The inflow to the reservoir from the PMP event is about 49,500 cfs. The spillway would be designed to accommodate the routed PMF outflow of 39,700 cfs (URS 2007a). That PMF flow would be a very rare event and is almost seven times greater than the maximum outflow of record in the existing spillway of 5,813 cfs (recorded on April 3, 1958). Thus, the proposed spillway would protect the dam from the possibility of being overtopped.



SOURCE: EDAW & Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.7: PROPOSED PLAN OF DAM AREA

The new spillway would be constructed at the western end of the dam and would be larger than the existing spillway. The ungated entrance to the spillway would be a 78-foot-by-307-foot L-shaped apron at Elevation 748 feet. The entrance would lie between two approach walls. The left approach wall would be constructed against the rock wall created by the excavation of the spillway, while the right approach wall would extend 62 feet into the reservoir, ending in a 24-foot-diameter circular section. The spillway crest would be a weir at elevation 756 feet. After flowing over the crest, flow would be directed first through an approximately 550-foot-long chute at a 3 percent slope that would turn to the right, then through a 550-foot-long steeper (30 percent slope) straight section. The spillway chute downstream of the crest would be a rectangular, concrete-lined channel that would narrow from 80 feet wide at the entrance to 60 feet wide at the top of the 30 percent slope straight section. The lower part of the spillway would end in a stilling basin that would dissipate the energy of the flow as it discharges into Calaveras Creek. The concrete-lined stilling basin would serve to reduce the velocity of water flowing in the spillway before being discharged into Calaveras Creek. The stilling basin would be 80 feet wide by 155 feet in length, 14 feet deep, and located at Elevation 542 feet. Below the stilling basin would be a discharge channel*, approximately 50 feet wide by 400 feet long to provide the connection between the stilling basin and Calaveras Creek that would discharge into Calaveras Creek approximately 1200 feet below the current discharge location. The discharge channel would be excavated in rock. If the quality of the rock is poor, the walls of the channel would be stabilized with shotcrete and rock bolting*. The overall length of the spillway, including crest, chute, stilling basin, and discharge channel, is expected to be about 1,950 feet.

3.4.2.2 Intake Shaft and Adits

A new intake structure would be constructed just south of the existing compressor building (see Figure 3.7). The structure would consist of a circular shaft excavated in rock to a depth of 163 feet and lined with reinforced concrete. The new shaft, which would have an inside diameter of 20 feet, would be larger than the existing one (12-foot diameter), to improve maintenance access to the intake valves. A concrete tower would extend above ground surface to a height of approximately 30 feet. The tower would have a removable roof to allow a crane to access the intake valves for maintenance. Intake valves would be a combination of new and refurbished valves.

The three existing adits and the existing drain would be retained and connected to the new intake shaft by four lateral tunnels excavated in rock. Another tunnel would be excavated in rock to accommodate a new pipeline connecting the new intake shaft to the existing outlet pipeline. An approximately 100-foot-long portion of the existing outlet pipeline downstream of the existing intake tower would be filled with concrete and abandoned. The portion of the existing intake tower shaft below grade would be filled with concrete and the portion above grade would be demolished.

3.4.2.3 Outlet Pipe and Stream Discharge Valves

Because the new dam would be located downstream of the existing dam, it would be necessary to extend the existing outlet conduit approximately 1,100 feet downstream (see Figure 3.7). As shown in Figure 3.7, the new outlet conduit would bifurcate into two pipelines at the toe of the replacement dam. As with the existing conduits, one branch would connect to a new pipe, approximately 350 feet long, that would be installed to connect to the existing 44-inch Calaveras Pipeline, while the other branch would connect to the relocated 72-inch-diameter cone valve and discharge to the new spillway stilling basin. There would be two new low-flow valves, each capable of releasing from 0.5 to 35 cfs, that would replace the existing low-flow valve. (see Section 3.3, Overview of the Existing Dam and Reservoir). One would be operated by SCADA; the other would be a back-up operated manually. These valves would discharge water to a separate energy dissipater before releasing it to Calaveras Creek. The stilling basin would be designed to accept and dissipate the energy associated with releases from the cone valve.

The new low-flow valves would increase operational flexibility for water releases and would be used for water releases to maintain fisheries and aquatic habitat, as called for under the 1997 MOU (see Section 3.6, Project Operation).

3.4.2.4 Supporting Facilities

The supporting facilities are shown on Figure 3.7. The HOS (approximately 45 feet by 65 feet) and bluestone building (approximately 30 feet by 50 feet) would remain in their present locations. The existing warehouse/compressor building would be demolished and replaced with a new 14-foot-wide-by-33-foot-long electrical equipment building (shown as the crest electrical equipment building on Figure 3.7). The potassium permanganate building (approximately 22 feet by 35 feet) would be demolished and would not be replaced because it would not be needed after planned upgrades to the SVWTP. A second new electrical equipment building (shown as the downstream toe electrical equipment building on Figure 3.7) would be constructed on the berm at the downstream toe of the replacement dam. Both electrical equipment buildings would be single-story pre-fabricated metal structures of similar size and design. Electric lines serve the existing dam and related structures; these lines would be relocated to serve the new dam.

The watershed keeper's residence, located south of the dam, would not be demolished, but would be vacated during construction.

3.4.2.5 Instrumentation

Instrumentation would be installed in the dam embankment and foundation, downstream of the dam, and in the abutments. The type, number, and location of instrumentation would be based on the specific engineering parameters that need to be monitored. These include lateral movement

of the dam embankment, settlement, seepage flows (as described previously, some seepage through the dam is expected), pore-water pressure*, and seismic response. Final selection would be made during the final design phase and coordinated with development of the automated data acquisition system. Table 3.2 lists the types and purpose of instrumentation currently recommended for installation at the dam.

Table 3.2: Proposed Instrumentation for the Calaveras Replacement Dam

Type of Instrument	Purpose
Piezometer (two types)	Measures pore pressure
Inclinometer	Measures lateral deformation
Survey Monument	Shows three-dimensional surface deformation
Weir	Measures seepage rate
Strong Motion Accelerograph	Measures earthquake acceleration time history
Reservoir Level Device	Measures reservoir level change

Source: URS 2005b, p. 7-9

Instrumentation data would initially be used to evaluate whether conditions following construction are consistent with design assumptions. During the long-term operation of the project, instrumentation data would be used to monitor the structural stability and performance of the dam. As data are compiled, trends under normal operation would be established, and the significance of variations under unusual events or loads, such as earthquakes, could be evaluated.

The monitoring frequency of the instrumentation systems would be determined during final design. The frequency of monitoring for each instrumentation system would be expected to vary during the life of the project. During construction and first filling of the reservoir, readings would be taken and evaluated at relatively frequent intervals so that any anomalous trends could be quickly identified and evaluated. As conditions stabilize and trends of values recorded by the instrumentation become established, the frequency of readings would generally be reduced. However, instrumentation systems would be monitored immediately after unusual events such as earthquakes or large rainstorms.

3.4.3 ALAMEDA CREEK DIVERSION DAM BYPASS FACILITY

The Alameda Creek Diversion Dam Bypass Facility would consist of a bypass tunnel through the ACDD abutment and a gate to control bypass flows. The facility is described in more detail in Subsection 3.5.2, Construction of Alameda Creek Diversion Dam Bypass Facility, and in Figure 3.14: Proposed Bypass Tunnel at Alameda Creek Diversion Dam. The ACDD bypass would permit controlled bypass flows from the ACDD; these flows are intended to provide suitable habitat conditions for rainbow trout in Alameda Creek below the ACDD. Operation of the ACDD bypass would be the primary means of providing rainy season releases for fish identified in the 1997 MOU, when sufficient flows are available.

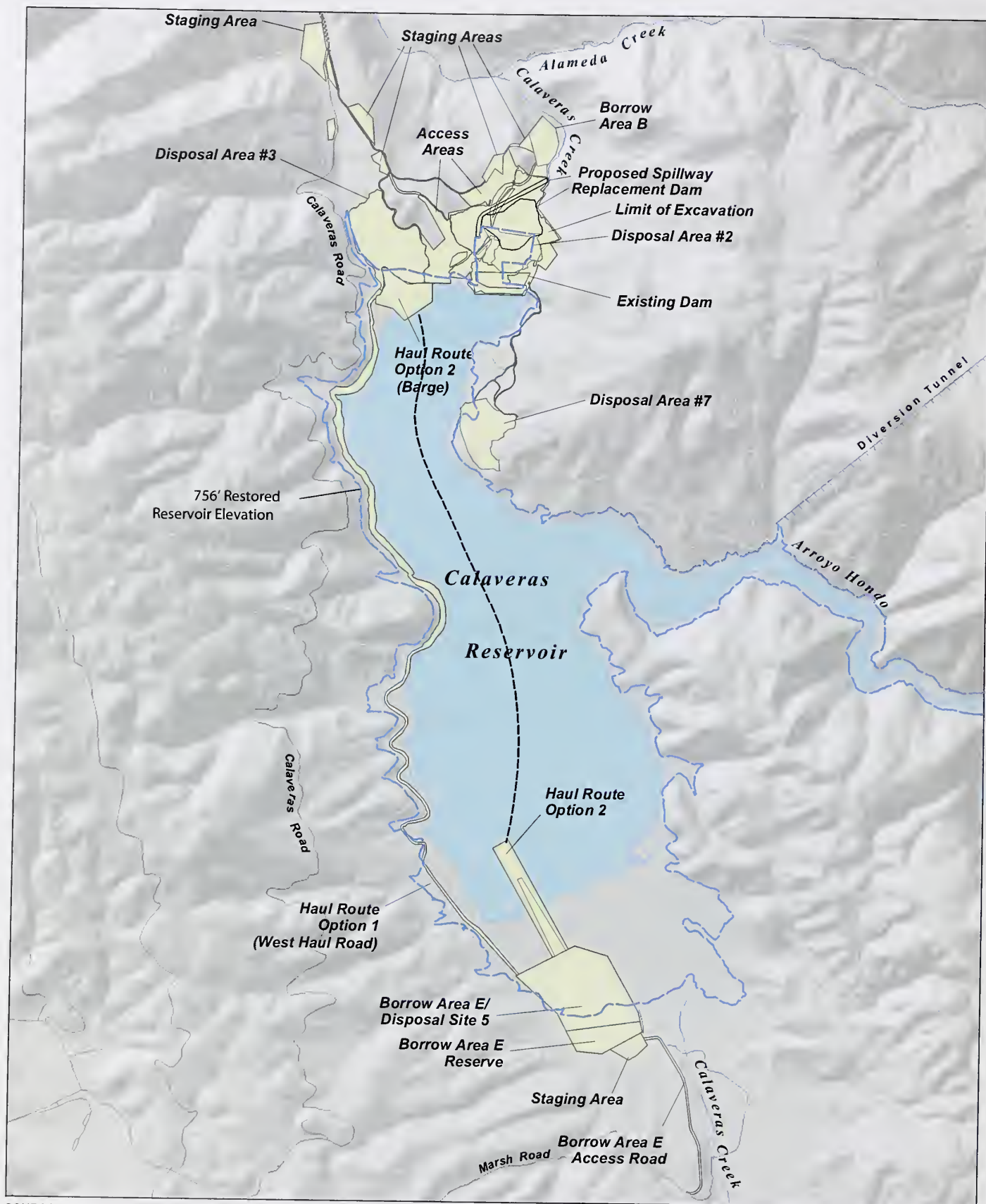
3.5 PROJECT CONSTRUCTION

3.5.1 CONSTRUCTION OF REPLACEMENT DAM

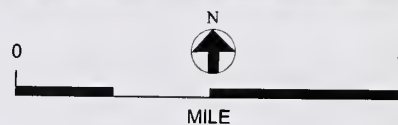
The primary construction activities for the proposed project would be the excavation of the dam foundation and spillway; transportation of fill materials from borrow areas* on the project site and from off-site sources; transportation of unusable soil and rock to disposal sites; construction of the dam embankment; forming and placement of concrete for the new intake tower/shaft and spillway; and extension of the outlet works. The project site would encompass borrow areas (areas of excavation that would provide some of the material for construction of the replacement dam); roads; staging areas (used for office trailers, on-site testing laboratory, materials storage, and stockpiles); disposal sites (used for the disposal of unsuitable and excess materials); and access areas (open areas used by construction vehicles and equipment to reach the various areas of excavation, staging areas, and disposal sites). Each of these elements of project construction is shown in Figure 3.8: Work Limit Area, and described in this subsection. SFPUC has established a work limit area. The construction contractor would be required to work inside this area. The work limit area includes all staging, borrow, disposal, and haul road areas, as well as the dam and related-facility construction sites. The total area affected by construction of the project elements would be approximately 343 acres.

3.5.1.1 Use of the Existing Dam as the Cofferdam

The new dam would be constructed at the downstream toe of the existing dam (see Figure 3.7). The existing dam would function as a cofferdam during construction of the replacement dam and would also provide 100-year storm* flood protection during construction while allowing the reservoir to remain at its current operating level. At the end of construction, an approach channel would be excavated through the west side of the cofferdam. The remaining portion of the cofferdam would be left in place. The excavated material from the cofferdam would be placed in one of the disposal sites (described in Subsection 3.5.1.6, Disposal Sites). Riprap would be placed on the surfaces between the replacement dam and the cofferdam for erosion protection.



SOURCE: URS



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.8: WORK LIMIT AREA

3.5.1.2 Excavation and Construction of the Foundation and Embankment

The replacement dam would be founded on bedrock. There are two types of bedrock at the project site: Temblor Sandstone in the left abutment and Franciscan Complex in the valley bottom and right abutment.¹⁰ The Franciscan Complex is known to contain naturally occurring asbestos (NOA). (Provisions for managing surplus materials from construction that could potentially contain NOA are discussed throughout this EIR.¹¹) These geologic formations have different characteristics and require different excavation depths to reach acceptable foundation levels. Excavation depths would also depend on whether the portion of the foundation would support either the dam shell zones or the core and filter zones. Based on geotechnical data, foundation excavations for the shell zones would extend from the ground surface to 25 feet below ground surface in Temblor Sandstone and 15 to 70 feet below ground surface in the Franciscan Complex. Foundation levels for the core and filter zones in the Temblor Sandstone would extend approximately 70 to 100 feet below ground surface through highly broken rock to groutable rock. In the Franciscan Complex, the core and chimney filter zones would be 35 to 80 feet below ground surface.

Construction of the dam foundation and embankment would occur over four construction seasons.¹² The first year of construction (2011) would be used to prepare disposal sites to receive materials excavated from the dam foundation. The dam foundation would be excavated working from the top of the left abutment and from the top of the right abutment to the valley floor during the second year of construction (2012) and the beginning of the third year of construction (2013). Approximately 2.325 million cubic yards would be excavated for the dam foundation (URS 2008c), including removing a portion of the downstream face of the existing dam in order to expose the foundation. About 150,000 cubic yards of rockfill from the existing dam also would be excavated (URS 2008c). Dam embankment construction would occur during the third and fourth years of construction (2013 and 2014). Excavation of the spillway from the top of Observation Hill would begin in the third season of construction. Observation Hill would be excavated into a series of benches and would have an overall slope of 1.3:1 (i.e., 1.3 horizontal to 1 vertical). During the third construction year, about 80,000 cubic yards of material would be placed for the downstream toe of the dam. During the third and fourth years of construction, the

¹⁰ At the dam site, the upper 100 feet of Temblor Sandstone is generally extremely to very weak, completely to highly weathered, and intensely to highly fractured* with zones of moderately strong, slightly weathered rock. Below about 100 feet, the Temblor Sandstone becomes generally moderately strong to strong, slightly weathered to fresh, and moderately to slightly fractured. The Franciscan Complex is characterized by a shale* matrix with inclusions of greywacke*, serpentinite*, silicious schist*, greenstone*, and blueschist*, which are known to contain naturally occurring asbestos (NOA). At the dam site, the Franciscan Complex has a lower hydraulic conductivity* than the Temblor Sandstone.

¹¹ Specifically, NOA-containing materials are discussed in this EIR in Section 4.7, Water Quality; Section 4.9, Hazards and Hazardous Materials; Section 4.12, Transportation and Circulation; Section 4.13, Air Quality; and Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project.

¹² The first construction season is assumed to be 2011, assuming Notice to Proceed is issued to the contractor in spring of that year. The second construction season is assumed to be 2012.

majority of the embankment material would be placed over a 24-month period. Placement of the embankment material must be completed during the dry season. At completion, the embankment would contain 2.77 million cubic yards of material.

Due to the hydraulic conductivity* properties of the bedrock, a seepage control system would be required in the dam foundation and in the left abutment. The foundation seepage control system in the Franciscan Complex and Temblor Sandstone would be a two-line grout curtain that would extend 100 feet below the core foundation surface in bedrock along the dam axis*. Cracks in the rock exposed in the core foundation would be filled with concrete before the earthen fill of the core is placed.

Several landslides have occurred on the right abutment downstream of the existing dam in the Franciscan mélange*. Those portions of the landslides that are located within the footprint of the proposed dam would be removed during foundation excavation. The largest landslide that would be affected by the foundation excavation is located approximately 400 feet downstream of the existing dam. This landslide is 300 to 400 feet wide and approximately 1,200 feet long, with a vertical height of approximately 400 feet. Geologic studies indicate that the landslide is between 20 and 65 feet deep to bedrock. Excavation of the dam foundation would cause movement of this landslide. Therefore, the landslide would require stabilization, both prior to dam foundation excavation in 2011 (Phase I) and following the completion of embankment construction near the end of 2014 (Phase 2).

Phase 1 stabilization would consist of a soldier pile* tie-back wall (URS 2007c). The tie-back wall would be constructed by first installing soldier piles drilled through the landslide and embedded up to 40 feet into bedrock, placed 5 feet on center. Tie-backs up to 60 feet in length would be installed through the soldier piles into bedrock as approximately 50,000 cubic yards of landslide material is excavated from the area in front of the wall. The wall would be up to 35 feet high and have up to four tiers of tie-backs.

Phase 2 stabilization would be a compacted buttress* fill built between the replacement dam and the existing dam. Approximately 595,000 cubic yards of Temblor Sandstone materials from the spillway excavation would be used to construct the berm (URS 2008b, Figure 3). Potential for movement of the landslide would be monitored with inclinometers during construction and during long-term monitoring of the final buttress.

Groundwater would be encountered during the excavation of the foundation in the valley bottom, and as seepage from the existing dam. Dewatering wells,¹³ well point systems,¹⁴ and seepage

¹³ Dewatering wells are used to lower the groundwater level and maintain the lower level until all below-ground construction has been completed.

¹⁴ A well point system is a group of small-diameter wells (each one is a well point) used to remove water from soil during construction.

collection trenches would be used to collect and control seepage into the foundation area and at the downstream toe of the existing dam. After any necessary treatment (see Section 4.7, Water Quality), extracted groundwater would be discharged to Calaveras Creek. Management and discharge of constructed-related seepage would require a National Pollutant Discharge Elimination System (NPDES) permit.

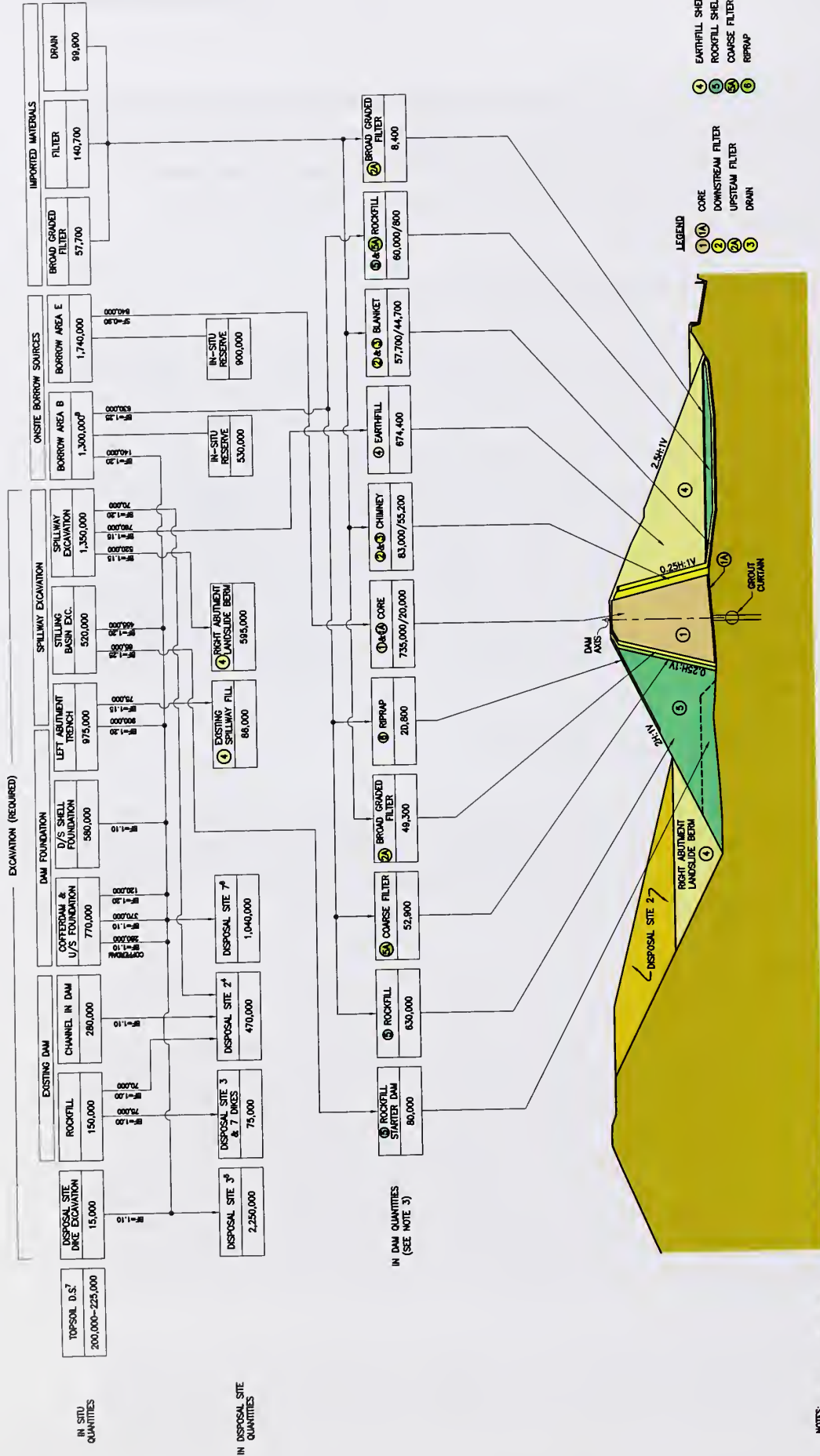
3.5.1.3 Excavation and Construction of the Spillway

The majority of the spillway would be excavated within Temblor Sandstone; the lower spillway chute and stilling basin would be in Franciscan Complex rock; the overall spillway excavation would include portions of Observation Hill and Hill 1000. Approximately 1.87 million cubic yards of material would be excavated for the spillway, including 520,000 cubic yards for the stilling basin in the first year of construction and approximately 1.35 million cubic yards for the spillway in the third and fourth construction years (URS 2008c). Spillway excavation would occur mostly in the third year of construction (2013) and final excavation and most of the concrete placement would occur in the fourth year (2014). The portion of the old spillway located upstream of the replacement dam footprint would be filled with about 86,000 cubic yards of material in the fourth year of construction to create an access road to the location of the new intake shaft (URS 2008c).

3.5.1.4 Sources of Material for Construction

The source of soil and rockfill materials for construction of the replacement dam is proposed to be derived from the same sources as those for the original dam construction, as well as those for the dam reinforcement project conducted in 1974. The replacement dam would be constructed from Temblor Sandstone and Franciscan Complex-derived fill and rock.

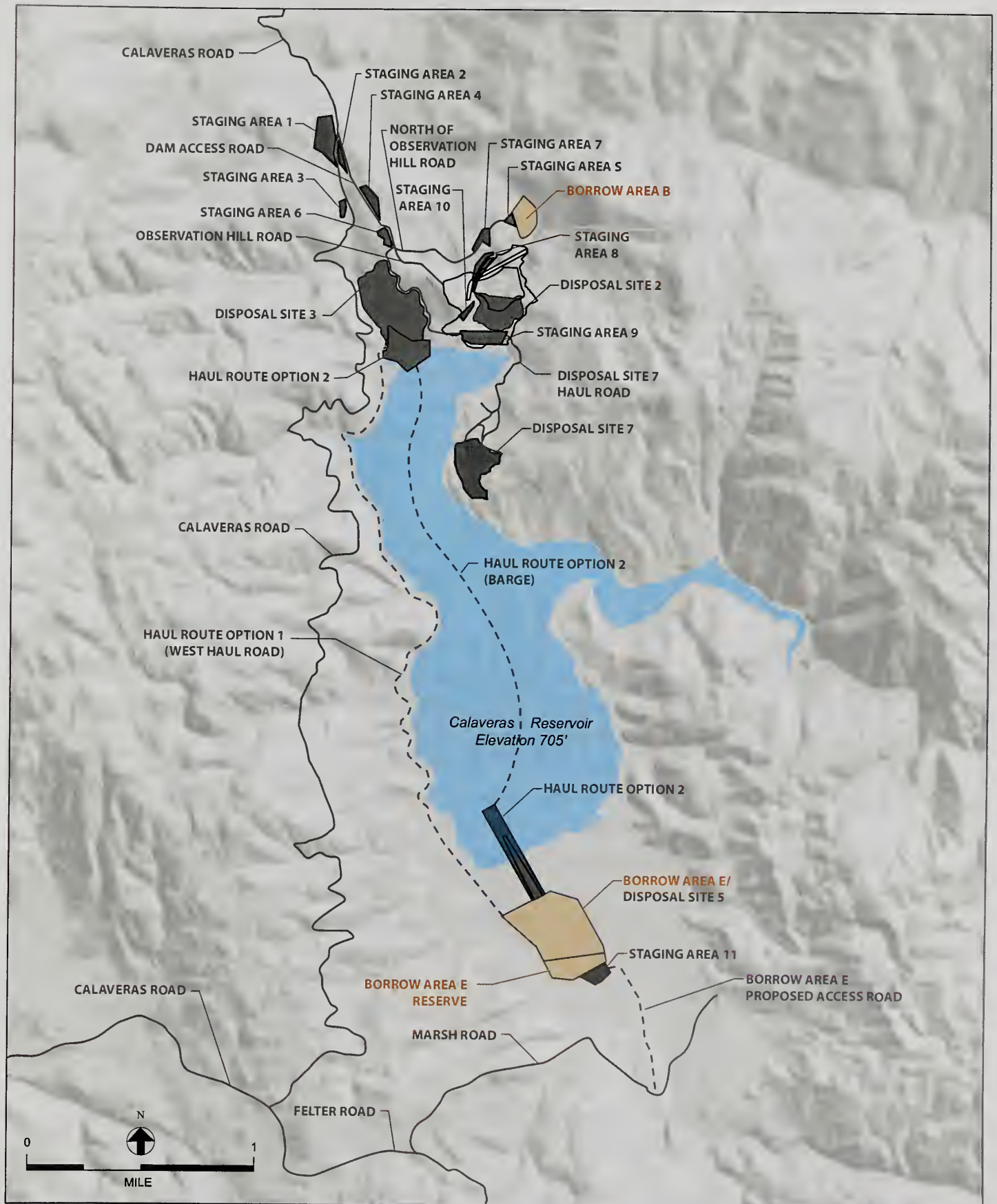
The new Calaveras Dam would require approximately 2.77 million cubic yards of material. Much of the material needed to construct the dam would be obtained from excavation of the new spillway, and from borrow areas in the vicinity of the reservoir (see Figure 3.9: Material Balance Diagram). One borrow area, Borrow Area B, would be located in the hills on the west side of Calaveras Creek, downstream of the existing dam (see Figure 3.10: Locations of Borrow Areas). Another borrow area, Borrow Area E, would be located at the south end of the reservoir. Figure 3.9 shows that for most types of material needed, the amount available on site should be more than adequate. Sand and gravel for filters and drains would be imported from commercial sources to be determined by the contractor. Sources of construction materials for the replacement dam are summarized in Table 3.3.



SOURCE: San Francisco Public Utilities Commission (2007)

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.9: MATERIAL BALANCE DIAGRAM



SOURCE: URS; EDAW&Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.10: LOCATIONS OF BORROW AREAS

Table 3.3: Sources of Construction Materials for the Calaveras Dam Replacement Project

Source of Material	Source Location ¹	Type of Material	Amount Excavated and Method of Excavation	Amount and Use in Dam Construction ²	Post-Construction
Spillway Excavation	Western end (left abutment) of proposed dam	Temblor Sandstone	1.87 million cu. yd. Excavated by blasting or ripping techniques	1,469 million cu. yd. Used for downstream embankment shell and right abutment landslide stabilization buttress	Spillway for replacement dam
Borrow Area B	North of proposed dam site, north of Hill 1000	Blueschist/greywacke	630,000 cu. yd. beneath 140,000 cu. yd. of Temblor Sandstone (additional 530,000 cu. yd. reserve) Temblor Sandstone removed by ripping or blasting; blueschist/greywacke removed by blasting	About 764,000 cu. yd. Used for coarse filter, rockfill, and riprap	After construction, area would be contoured for drainage and, where possible, revegetated
Borrow Area E	South end of reservoir	Alluvium	840,000 cu. yd. (900,000 cu. yd. reserve) Obtained by mechanical excavation only; no blasting required	About 755,000 cu. yd. Used for core of dam.	After construction, most of the area would be shaped to drain and submerged after reservoir refilled
Off-site Commercial Sources	To be determined	Sand and gravel	To be determined	298,000 cu. yd. Used for filters, drains, and concrete aggregate	NA
Cu. yd. – cubic yards; NA – Not applicable.					
<i>Notes:</i> ¹ See Figure 3.7 for the location of the new spillway and Figure 3.8 for the locations of the Borrow Areas. ² The new Calaveras Dam would require approximately 2.772 million cubic yards of material. See Figure 3.9 for the material balance diagram showing material quantities.					

Source: URS 2008c

Spillway Excavation

The Temblor Sandstone that would be a by-product of the excavation of the new spillway (which is part of the overall dam site excavation) would be used as shell embankment material for the downstream shell of the dam and for the right abutment landslide buttress. The spillway excavation contains approximately 1.87 million cubic yards of in-situ materials, which are primarily Temblor Sandstone (URS 2008c). Approximately 1.28 million cubic yards of this material would be used to produce 1.469 million cubic yards¹⁵ of earthfill material in the downstream embankment shell and right abutment landslide stabilization buttress. The excess material would be placed between the existing dam and new dam and in other disposal sites, as described below. Material could be excavated from this area by ripping or blasting techniques. The slopes at the northern and southern ends of the spillway excavation area, which are both excavated in rock, would be graded into a series of benches and stabilized with shotcrete and bolting.

Borrow Areas

Borrow Areas B and E are described below.

Borrow Area B

Borrow Area B would be located north of the proposed dam site above the west bank of Calaveras Creek just north of a hilltop known as Hill 1000 (shown on Figure 3.7). Borrow Area B is approximately 8 acres. This area would be excavated to a depth of approximately 200 to 280 feet. Borrow Area B contains approximately 1.3 million cubic yards (URS 2008c) consisting of blueschist/greywacke* that underlies 140,000 cubic yards of Temblor Sandstone. The Temblor Sandstone would be removed by ripping or blasting and would be disposed of in one of the disposal sites. Approximately 630,000 cubic yards of blueschist/greywacke would be removed and would produce about 764,000 cubic yards of material for the dam. The blueschist and greywacke are the hardest, strongest rocks encountered in the project area and would be used for coarse filter, rockfill, and riprap. Because of its hardness and strength, production of the blueschist/greywacke would require blasting. At the conclusion of construction, the borrow area would be contoured to drain and prevent rainwater from pooling.

Borrow Area E

Borrow Area E would be located at the south end of the reservoir. It contains 1.740 million cubic yards of alluvium* that could be used for the core of the dam. Approximately 840,000 cubic

¹⁵ Temblor Sandstone rock is denser in the ground prior to excavation than after excavation and placement in the dam. It is estimated that 1 cy of Temblor Sandstone in the ground will swell to 1.15 to 1.20 cy in the embankment.

yards of this material would be removed to produce 755,000 cubic yards¹⁶ of material for the dam. Borrow Area E is approximately 85 acres in area and would be excavated by conventional excavation methods to a depth of 10 to 20 feet. The material could be obtained by excavating; blasting would not be required. Because this area is located on the reservoir shoreline, a drainage channel with check dams would be used to prevent discharge of sediment to the reservoir. Use of this area would require either construction of a haul road on the west side of the reservoir or the use of barges (see Subsection 3.5.1.7, Access and Roads, for a description of these haul route options). If the haul road option is chosen, an approximately 3.4-mile-long road would be constructed along the west shore during the second year of construction. If the use of barges is chosen, mooring sites would be constructed and loading/unloading equipment would be placed at the north and south ends of the reservoir. After construction, these areas would be shaped to drain, as most of them would be submerged when the reservoir is refilled.¹⁷

Borrow Area E is located near the former Calaveras Test Site. The SFPUC has established the former Calaveras Test Site and known area of trichloroethene contamination as a borrow avoidance area; therefore, soil contaminated with trichloroethene and other hazardous materials from the Calaveras Test Site would not be used for dam construction. Although Borrow Area E is located outside of the known extent of the trichloroethene plume at the former Calaveras Test Site, excavation at this site would be limited to a depth of 10 to 20 feet below ground surface. In addition, the construction contract requirements would specify that any gravel layers that may be exposed along the eastern edge of Borrow Area E, closest to the former Calaveras Test Site, shall be covered with a clay blanket to reduce the potential for groundwater movement toward the regraded borrow area after the reservoir level has been restored. See Section 4.9, Hazards and Hazardous Materials, for a further discussion of the former Calaveras Test Site.

Off-Site Sources for Sand and Gravel

Sand and gravel for filters, drains, and concrete aggregate* would be imported from off-site commercial sources. The closest source is located about 7 miles north of the dam site, on Calaveras Road at the Sunol quarries. However, although this is the closest source, the contractor would determine which source it will use.

¹⁶ Clay alluvium is less dense in the ground prior to excavation than after excavation and placement in the dam. It is estimated that 1 cy of alluvium in the ground will shrink to 0.9 cy in the embankment.

¹⁷ A small segment (about 1 acre) of the west haul road would not be inundated by the reservoir when it is refilled to elevation 756 feet.

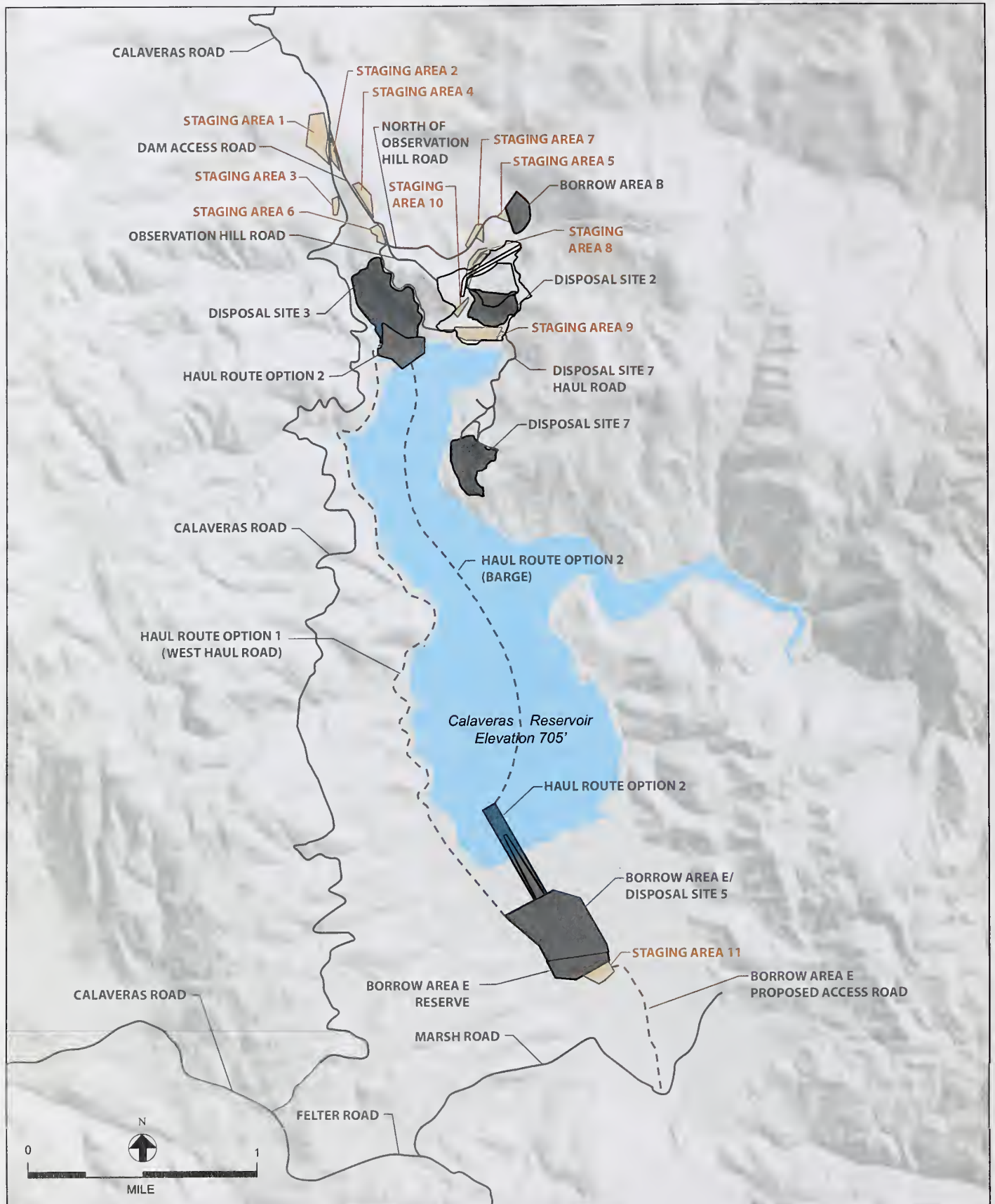
3.5.1.5 Construction Staging Areas

Eleven construction staging areas would be required for the contractor's and SFPUC's office trailers, on-site soils testing laboratory, equipment and maintenance yards, construction materials storage, and stockpiling of imported filter, drain, and aggregate materials. (See Figure 3.11: Locations of Staging Areas.) The combined total extent of the staging areas would be 35.4 acres. Staging Areas 1 and 2 would be located where the dam access road joins Calaveras Road. Staging Areas 3 and 4 would be located near the junction of the existing dam access road with Calaveras Road (Area 3 would be located on Calaveras Road, and Area 4 would be located on the dam access road). These areas near Calaveras Road are relatively flat so that limited grading would be required. Staging Areas 5 through 8 and 10 would be located near the dam and spillway construction areas. Staging Area 9 would be located on the top of the existing dam, before it is leveled off. Staging Area 11 would be located at the south end of the reservoir adjacent to Borrow Area E. Best Management Practices (BMPs) and a Storm Water Pollution Prevention Plan (SWPPP) would be used at all staging areas to minimize or avoid water quality impacts of erosion from exposed soils. BMPs and SWPPP provisions are discussed in detail in Section 4.7, Water Quality.

3.5.1.6 Disposal Sites

Disposal options would be required for unsuitable and excess material generated from the excavation associated with the foundation, spillway, borrow areas, haul roads, staging areas, and partial removal of the existing dam (URS 2006a). Several off-site and on-site options were evaluated (URS 2008c). The disposal volume is currently estimated to be approximately 3.8 million cubic yards (URS 2008c).¹⁸ Of this volume, approximately 2.4 million cubic yards are soil and rock from the Franciscan Complex and may contain concentrations of NOA. Because the disposal volume is so large, off-site disposal was determined to be infeasible based on cost and logistics. Eight disposal sites within the project area were identified based on capacity (able to hold at least 500,000 cubic yards of material) and access (able to offer reasonable access from the dam site during construction). Biological resource considerations (e.g., wetlands and special status species) and geologic conditions on these sites were then evaluated, and three of these sites were eliminated from further consideration. The five remaining disposal sites were then joined in combinations to form five specific on-site disposal options with sufficient capacity to accommodate all of the excess material. These five specific options were ranked based on an evaluation of biological resources, water quality, and air quality.

¹⁸ In addition to the 3.8 million cubic yards of excess material that would be placed in the disposal sites, an additional volume of approximately 75,000 cubic yards of material would be used to construct retention dikes for Disposal Sites 3 and 7. (Note: the retention dikes proposed for Disposal Sites 3 and 7 would be earthen walls to protect the base of the disposal site from eroding into the reservoir.)



SOURCE: URS; ED&W&Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.11: LOCATIONS OF STAGING AREAS

as well as practicability factors such as cost, schedule, and logistics (URS 2008c). On the basis of the evaluation, four disposal sites (Sites 2, 3, 5, and 7) have been identified (see Figure 3.12: Locations of Disposal Sites, and Table 3.4).

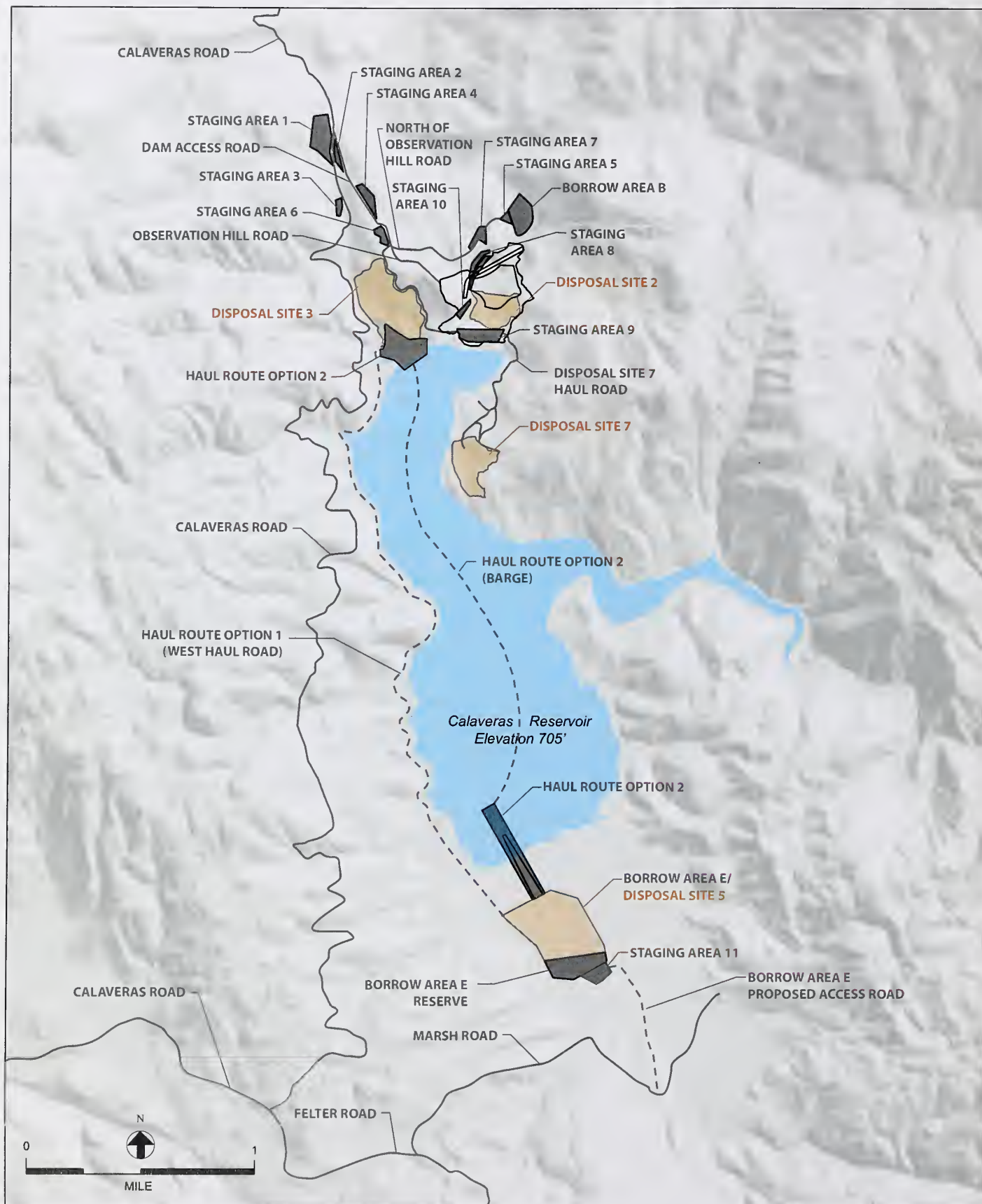
To prepare the disposal sites, topsoil would be stripped from the sites. The soil would be stored before excess rock and soil material (spoil) is deposited. With the exception of rockfill from the upstream side of the existing dam and the toes of the disposal sites, excavated materials that may potentially contain NOA would be placed in the disposal sites at or above Elevation 760 feet (4 feet above the proposed normal maximum reservoir surface elevation of 756 feet) to prevent NOA from coming into contact with the reservoir surface water. Spoil material would be deposited and spread in approximately 24-inch lifts, then compacted by a bulldozer. At those disposal sites where excavated material containing NOA has been placed, 4 feet of Temblor Sandstone would be used to cover the NOA-containing material. At project completion, the disposal sites would be contoured to blend into the existing topography and graded to have slopes no steeper than 3:1 (3 horizontal to 1 vertical).

Surface water runoff would either infiltrate to or be diverted by rock-lined swales. The swales would be installed on 10-foot-wide benches placed at approximately 50-foot vertical intervals. Surface runoff upslope of the disposal sites would be collected in swales, routed around the disposal sites, and allowed to infiltrate to reduce surface water volume near the disposal sites. Natural materials would be used to simulate the natural environment as much as possible. The topsoil would be replaced on the final grade and portions of the disposal sites that would not be inundated after the reservoir fills would be hydroseeded* to restore native vegetation. There could be some differences in restoration depending on the disposal location. BMPs and a SWPPP would be used at all disposal sites to avoid or minimize impacts to water quality from erosion of exposed soils during construction. (BMPs and provisions of SWPPPs are discussed in greater detail in Section 4.7, Water Quality, and Section 4.8, Geology, Soils, and Seismicity.)

Disposal Sites 2, 3, 5, and 7 are discussed in detail below.

Disposal Site 2

As shown in Figure 3.12, Disposal Site 2 would take advantage of the space between the existing dam (which would serve as a cofferdam during construction, as described in Subsection 3.5.1.1, Use of the Existing Dam as the Cofferdam) and the replacement dam. This site would become available during the second construction season as the replacement dam is constructed. Excess material from the spillway excavation could be placed at this location. A channel leading to the new spillway would be excavated through the west side of the cofferdam, and the excavated material from the cofferdam would be placed in Disposal Site 2. Rockfill from the existing dam would be placed on the surface of the disposal site for erosion protection. Approximately



SOURCE: URS; EDAW&Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.12: LOCATIONS OF DISPOSAL SITES

Table 3.4: Disposal Sites Identified for the Calaveras Dam Replacement Project

Disposal Site	Location ¹	Estimated Maximum Disturbance Area (acres)	Capacity ² (cubic yards)	Haul Distance (miles)	Post-Construction
2	Between cofferdam and replacement dam	0 – area is already disturbed	900,000	0.4	Most of the site would be under water when reservoir is refilled.
3	Drainage in reservoir west of existing dam	39	2.48 million	0.9	Final grade of site would be configured to allow restoration of wetland and riparian vegetation, except 7.3 acres below normal water surface elevation of 756 feet.
5	In Borrow Area E (back-up site, if needed)	60 ³	840,000	3.4	Most of the site would be underwater when reservoir level is restored to Elevation 756 feet.
7	Corral Point on east side of reservoir	17	1.06 million	1	Site would be recontoured and reseeded, except 0.4 acre below normal water surface elevation of 756 feet.

Notes:¹ See Figure 3.12 for the locations of the disposal sites and the roads that would serve them.² This capacity may not be used – text identifies expected volumes to be deposited.³ Does not include 25 acres that would be temporarily disturbed during stockpiling of materials adjacent to Borrow Area E during the first construction season.

Source: URS 2008a

470,000 cubic yards of waste materials would be placed within an area of approximately 16.6 acres between the new and existing dams. About 13.9 acres of the site would be below the proposed normal maximum water surface elevation of 756 feet when the reservoir is refilled.

Disposal Site 3

As shown in Figure 3.12, Disposal Site 3 would be located to the west of the existing dam above the northwestern corner of the reservoir alongside Calaveras Road. The footprint of the disposal area has been configured to avoid impact to the perennial creek that flows in the valley bottom due to being exposed by the reduced reservoir level. The site could contain up to approximately 2.48 million cubic yards of material on an area of approximately 39 acres, 7.3 acres of which would be located below the normal maximum water surface elevation of 756 feet when the reservoir is refilled. The haul distance to this disposal site would be approximately 0.9 mile.

A rockfill dike would be constructed across the drainage at the south edge of the site that would extend below the restricted reservoir water level to about Elevation 700 feet (URS 2008c). The dike would consist of hard rock blueschist and would have a top elevation of 730 feet. The dike would retard erosion of the edge of the fill when the water line is at Elevation 730 or less. Material would be placed behind the dike and would fill the drainage. Construction within Disposal Site 3 would begin in the first year of construction with the placement of 55,000 cubic yards of material for the dike. Construction of the dike would include excavation of approximately 10,000 cubic yards of material along the shore of the reservoir. In advance of excavation, a sheet pile wall or other control structure would be used to prevent sediment from migrating into the reservoir. During construction of the dike, turbidity would be monitored as part of implementing the construction SWPPP, and additional controls would be implemented as necessary. Once the excavation has been completed, hard rock blueschist would be placed to form the dike. In order to avoid placing material potentially containing NOA below the restored reservoir pool elevation, any material placed behind the dike or below the elevation of 760 feet would be Temblor Sandstone and would not contain NOA.

This disposal site would rise to the northeast to a maximum elevation of 960 feet. Water from springs and seeps within the footprint of the disposal site would be collected and conveyed under the disposal site to the reservoir through sand and gravel finger drains. The final grade of the site would be configured to allow revegetation and would include a recontoured drainage channel at the west side of the fill; the fill would approximate the contours of the adjacent hilly topography.

After the reservoir is refilled to Elevation 756, reservoir water in the drainage channel would form an inlet west of the disposal site. The shoreline within the inlet at Disposal Site 3 would be restored and managed to encourage the re-establishment of riparian vegetation and transitional vegetation between riparian and upland areas. To minimize erosion, approximately 1,000 linear feet at the base of the south side of the disposal site would be protected by riprap. The remainder

of the disposal site would be restored by hydroseeding with a native grasses erosion control seed mix.

Disposal Site 5

Disposal Site 5 would be used if the amount of surplus rock and soil exceeds the capacity of Disposal Sites 2, 3, and 7, or if local disposal is needed for materials from the barge option. (The option to use barges is described below in Subsection 3.5.1.7, Access and Roads.). Disposal Site 5, which would be located in Borrow Area E, would be about 60 acres in size (URS 2008c, Table 3). The haul distance would be the same as that to Borrow Area E – approximately 3.4 miles. Due to construction sequencing, this site would not be available until the third construction season (described in Subsection 3.5.5, Construction Schedule) when it could be used for placement of a portion of the excess materials from spillway excavation, material dredged for a barge access channel, or rockfill materials from construction of the barge loading facility. Vehicles hauling core materials to the dam from Borrow Area E could return with excess excavated materials for disposal at this site. Materials that could potentially contain NOA would not be placed in this disposal site. When the reservoir level is restored to Elevation 756 feet, most of this site would be under water.

Disposal Site 7

Disposal Site 7 would be located on a terrace on the east side of the reservoir at Corral Point. This site could accommodate approximately 1.06 million cubic yards of material (URS 2008c) on an area of approximately 17 acres, 0.4 acres of which would be located below the normal maximum water surface elevation of 756 feet when the reservoir level is restored. The haul distance to this site would range from about 1.0 to 1.2 miles. Work at Disposal Site 7 would begin in the first year of construction with the placement of 20,000 cubic yards of material for the dike, which would be constructed to Elevation 756 feet. The dike would consist of hard rock blueschist and would be constructed in a manner similar to Disposal Site 3, described above, to simulate the natural topography and to encourage native grass revegetation. Construction of the dike would include excavation of about 5,000 cubic yards of material along the shore of the reservoir. In order to avoid placing material potentially containing NOA below the restored reservoir pool elevation, material placed behind the dike would be compacted Temblor Sandstone and would not contain NOA.

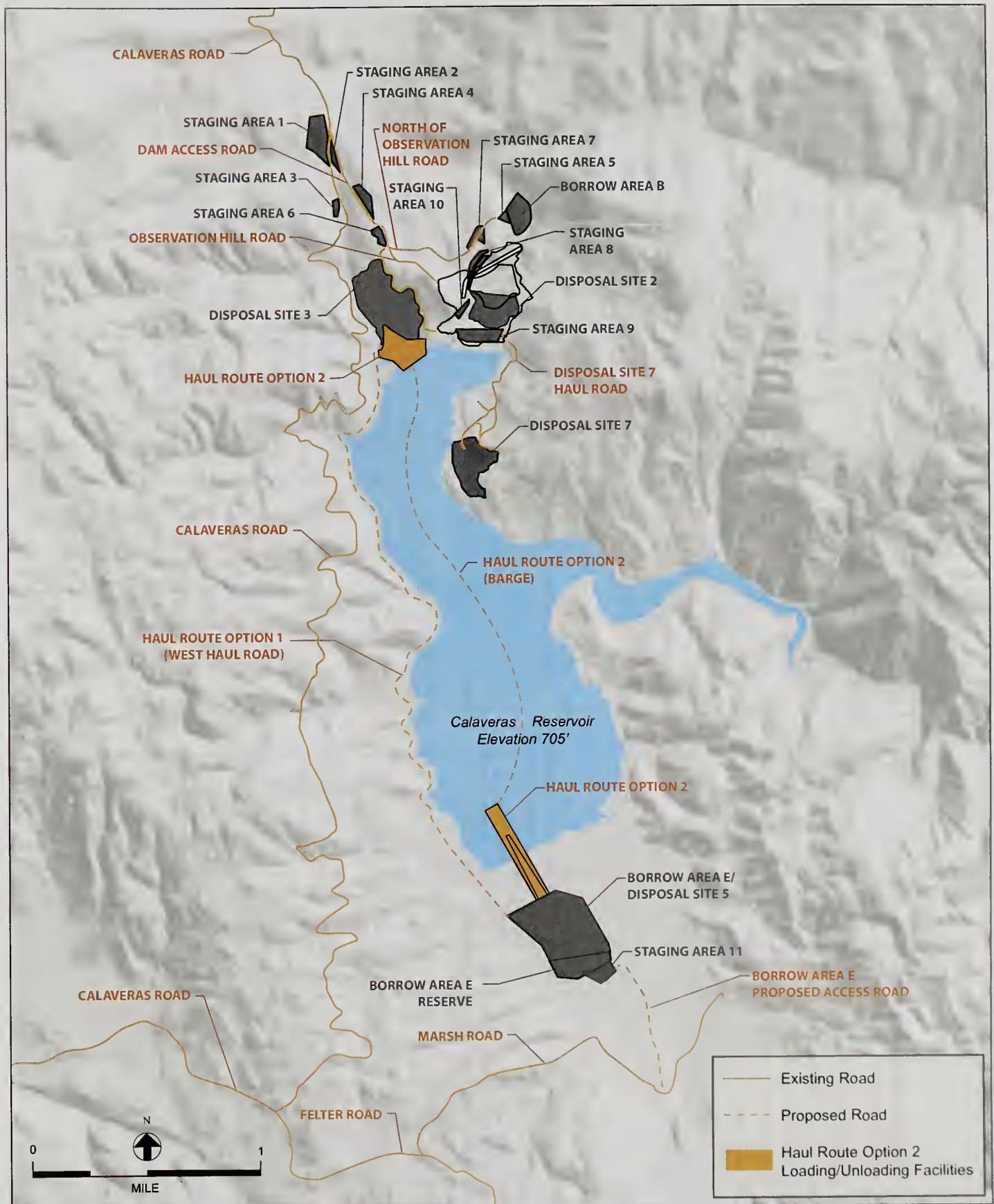
This disposal site would slope upward to the east to a maximum elevation of 870 feet. Water from springs and seeps within the footprint of the disposal area would be collected and conveyed under the disposal site to the reservoir through sand and gravel finger drains. As with Disposal Site 3, erosion protection measures and benching and surface water ditches would be provided for this disposal site to prevent erosion and promote restoration of the slopes. The disposal site would be revegetated by hydroseeding with a native grasses erosion control seed mix.

3.5.1.7 Access and Roads

Construction traffic for the CDRP would use existing public roads and SFPUC private roads in the SFPUC watershed area. Some of the SFPUC roads would require improvements, and temporary roads would have to be constructed. These roads are shown in Figure 3.13: Existing Roads, Proposed Roads, and Haul Route Options, and described in Table 3.5.

Calaveras Dam and Reservoir are accessed by Calaveras Road and the dam access road. Calaveras Road between Interstate 680 and the dam access road is the main access road to the project area from off site. It would be used by trucks hauling imported materials and transporting construction equipment, and by work crews coming and going from the general project area.

Calaveras Road north of the dam, i.e., between Interstate 680 and the dam access road, would be used as the major hauling route for imported materials for dam construction. For traffic safety reasons, the SFPUC would request permission from Alameda County to close the section of Calaveras Road between a point immediately south of the intersection with Geary Road (south of the SVWTP) and a point near the Santa Clara County line (south of the dam access road) to the public, Monday through Friday except for emergency vehicles, for hauling of the imported materials for the dam during two periods. The road would be closed for approximately 2 months in summer 2011, then reopened. The second closure period would last for approximately 18 months beginning in winter 2012. In addition, the SFPUC would request permission from Santa Clara County to close the portion of Calaveras Road between the Alameda County line and Felter road (near the south end of the reservoir) during the same two periods; the purpose of the additional closure would be to prevent private vehicles that may enter Calaveras Road from the south from the need to turn around at a dead end at the Alameda County line. The SFPUC may also need to request permission to close these sections of Calaveras Road in both Alameda and Santa Clara Counties at other times, possibly including weekend days, when air quality monitoring indicates unacceptable levels of dust (see Section 4.9, Hazards and Hazardous Materials, for further discussion). The section of Calaveras Road north of Geary Road would remain open during construction and would be used by both private and construction vehicles. Some heavy equipment may be delivered to Borrow Area E or the adjacent Staging Area 11 by trucks traveling on Interstate 680 to the southern portion of Calaveras Road in Milpitas and then on Felter Road and Marsh Road. No improvements to Calaveras Road are expected to be needed to facilitate project construction. Following construction, Calaveras Road between Interstate 680 and the dam access road would be repaved as needed to restore the road to its pre-construction condition.



SOURCE: URS; EDAW&Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.13: EXISTING ROADS, PROPOSED ROADS, AND HAUL ROUTE OPTIONS

Table 3.5: Improvements to Project Area Roads

Description	Existing or New Road ¹	Road Type	Approx. Route Length (miles)	Approx. Total Disturbed Area (acres)	Improvements/Comments
Calaveras Road	Existing	Paved	-		• No improvements necessary. ²
Felter Road	Existing	Paved	-		• No improvements necessary. ²
Marsh Road	Existing	Paved	-		• No improvements necessary. ²
Dam Access Road	Existing	Paved	1.4	0.6	• Portion from Calaveras Road to the existing dam likely to require resurfacing at end of construction. • Some tight curves would require widening. • 0.6 mile of paved road at dam would be demolished and 0.8 mile of new paved roadway would be constructed on new dam.
North Observation Hill Road	Existing	Unimproved	0.8	0.4	• Potential widening.
Observation Hill Road	Existing	Unimproved	0.3	0.6	• Potential widening.
Observation Hill access area	New	-	Note 3	11.6	• The contractor would design roads within the access area as needed.
Hill 1000 access area	New	-	Note 3	10.1	• The contractor would design roads within the access area as needed.
Borrow Area B	Existing	Unimproved	Note 3	0.3	• The contractor would design temporary roads within the access area as needed.
Borrow Area B access area	New	Unimproved	Note 3	1.4	• The contractor would design roads within the access area as needed.
Dam excavation access areas	New	Unimproved	Note 3	14.6	• The contractor would design roads within the access area as needed.
Right Abutment Access Road	Existing	Unimproved	0.3	04	• 0.2 mile of unimproved road would be relocated between new dam and existing dam.

Table 3.5 (continued)

Description	Existing or New Road	Road Type	Approx. Route Length (miles)	Approx. Total Disturbed Area (acres)	Improvements/Comments
Disposal Site 7 haul route	Existing	Paved Segment	0.4	0.1	Construct turnouts
	New	Unimproved Segment	0.6	0.2	Construct turnouts
Borrow Area E access road	New	Unimproved	0.69	3.0	About 0.69 mile of unimproved road would be constructed between Borrow Area E staging area and Marsh Road.
Borrow Area E Options					
West Shore Haul Route	New	Unimproved	3.4	35	All temporary fill in wetlands or other waters would be removed after project completion. Most of road would be below Elevation 756 when reservoir is restored. Cut slopes above Elevation 756 would be hydroseeded and stabilized.
Barging	New / NA ⁵	NA	NA	NA	Requires docking facilities at north and south ends of reservoir. Docking facilities would be removed after replacement dam completed.
<i>Notes:</i> NA – Not applicable ¹ All roads in Table 3.5 are owned and maintained by the SFPUC except for Calaveras Road, Felter Road, and Marsh Road, which are open to the public. Borrow Area E Option 2, barging, would not involve the use of roads. ² Mitigation measures to address impacts to roads are presented in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project. ³ The approximate route length depends on the number of access roads the contractor requires within the access area. ⁴ Disturbed area is within the limit of grading. ⁵ Docking facilities at north and south end of reservoir.					

Source: URS 2008b

The existing dam access road is a 1.2-mile stretch of single-lane roadway connected to Calaveras Road south of Geary Road. The dam access road would require improvements for construction traffic that would include a short (approximately 0.2-mile) extension and could include increasing the radius of some turns to allow access for large construction vehicles and constructing turnouts. Less than 1 acre would be disturbed as a result of the improvements to the existing dam access road. The exact location and description of the proposed improvements have not been determined.

New roads would be created to access the construction area. Typically, haul roads that would be used for two-way traffic would require a width of between 30 and 40 feet depending on the type of hauling equipment used on that road. Most haul roads would be between 15 and 20 feet wide and would be gravel-surfaced or sprinkled with water for dust control. The access roads constructed within the access areas to the stilling basin, Observation Hill, Hill 1000, Disposal Site 7, and the lower portion of Borrow Area B would become permanent roads.

The contractor would determine the optimum location and alignment of the haul roads that would be used for dam and spillway excavations and to provide access to Disposal Site 2. There would be approximately six roads constructed for this use. These roads would disturb a total of approximately 39.6 acres of land.

One road would be located on the northeast side of the reservoir using an existing road alignment, extending between the dam and Disposal Site 7. This route would be about 1 mile long, and would cross several minor drainages where culverts* would be required. This route would disturb approximately 0.3 acre above reservoir elevation and would end at Disposal Site 7.

An access road would be constructed from Marsh Road to Staging Area 11 on the south side of Borrow Area E. This road would be about 0.69 mile long and would be located west of Calaveras Creek, thus avoiding a crossing of the creek bed.

The longest haul distance would access Borrow Area E, Disposal Site 5, and Staging Area 11 at the southern end of the reservoir. There are two options to provide this haul route: a temporary haul road on the western shore of the reservoir, and barging (URS 2007b).

- Haul Route Option 1 is the west haul road route. This route would require construction of a new haul road that would lie mostly below the new water line at the 756-foot elevation of the filled reservoir. This new haul road would be approximately 3.4 miles long and would disturb approximately 3 acres above Elevation 756 and 32 acres below Elevation 756. It would cross several minor drainages, and culverts would be required at these drainage locations. The southern half of the road would be a 40-foot-wide road that would allow for two-way traffic. Due to topographic and geologic conditions, the northern half of the road would be either a single-lane 20-foot-wide road with turnouts or two single-lane 20-foot-wide roads built at different elevations to allow two-way traffic. There would be approximately 240 round-trips per day on this route.

- Haul Route Option 2 involves using barges to cross the reservoir. As shown in Figure 3.13, this option would require that a rockfill jetty up to 1,000 feet long be constructed at Borrow Area E and either a floating dock or two jetties up to 500 feet long be constructed at the north end of the reservoir for material loading onto and off the barges. The fill material for the jetties would be rockfill excavated from the upstream berm of the existing dam. Timber or sheet piles would be driven along the jetties to anchor the barges during loading and unloading operations. The actual size and details of the jetties or other docking facilities would be determined by the contractor. If needed, access lanes for the barges would be dredged. Materials dredged at the south end of the reservoir would be placed in Disposal Site 5 and materials dredged at the north end of the reservoir would be placed in Disposal Site 3. The method and equipment to be used to load and unload the barges would be determined by the contractor. Excavators, conveyor belts, or loaders could be used. Three barges, each with a capacity of 560 tons, would be used. Up to two diesel-powered boats would be used; each barge would make six round trips per day.

Based on considerations of cost and schedule, Haul Route Option 1, the west haul road, is the most likely route to be implemented by the construction contractor. Haul Route Option 2, barge across the reservoir, is considered less efficient than Haul Route Option 1, but may be used to avoid potential impacts on nesting bald eagles (see Section 4.4, Vegetation and Wildlife).

Roads remaining at the end of construction, or permanent roads, would include the improved dam access road, a new dam crest road, an access road to the downstream toe of the replacement dam, the Borrow Area E access road, and improved portions of previously existing unimproved roads.

3.5.1.8 Demolition and Construction of Support Buildings

Several small support buildings that are associated with the maintenance of the dam and operation of the reservoir would be demolished and replaced later. The maintenance warehouse/compressor building would be demolished; the bluestone building and HOS facility would be unaffected. A new electrical equipment building (referred to as the dam crest electrical building) would be constructed in the vicinity of the prior location of the demolished warehouse/compressor building and a second electrical equipment building (referred to as the downstream toe electrical building) would be constructed on the berm at the toe of the new dam. The potassium permanganate building would be demolished and would not be replaced. The electric lines would be removed and rerouted for the proposed new facilities.

3.5.1.9 Blasting

Blasting would be required 1) for excavation for the foundation of the dam, 2) for excavation of the left (west) abutment for the spillway excavation and to provide materials for construction of the replacement dam, and 3) in Borrow Area B to provide rockfill for construction of the replacement dam. Blasting could be expected to occur as frequently as each day and would occur throughout the construction period. Blasting would take place during daylight hours, Monday

through Friday. Informational signs would be posted at the trailheads of affected trails so that hikers can choose to use an alternative trail if they wish to avoid blasting noise.

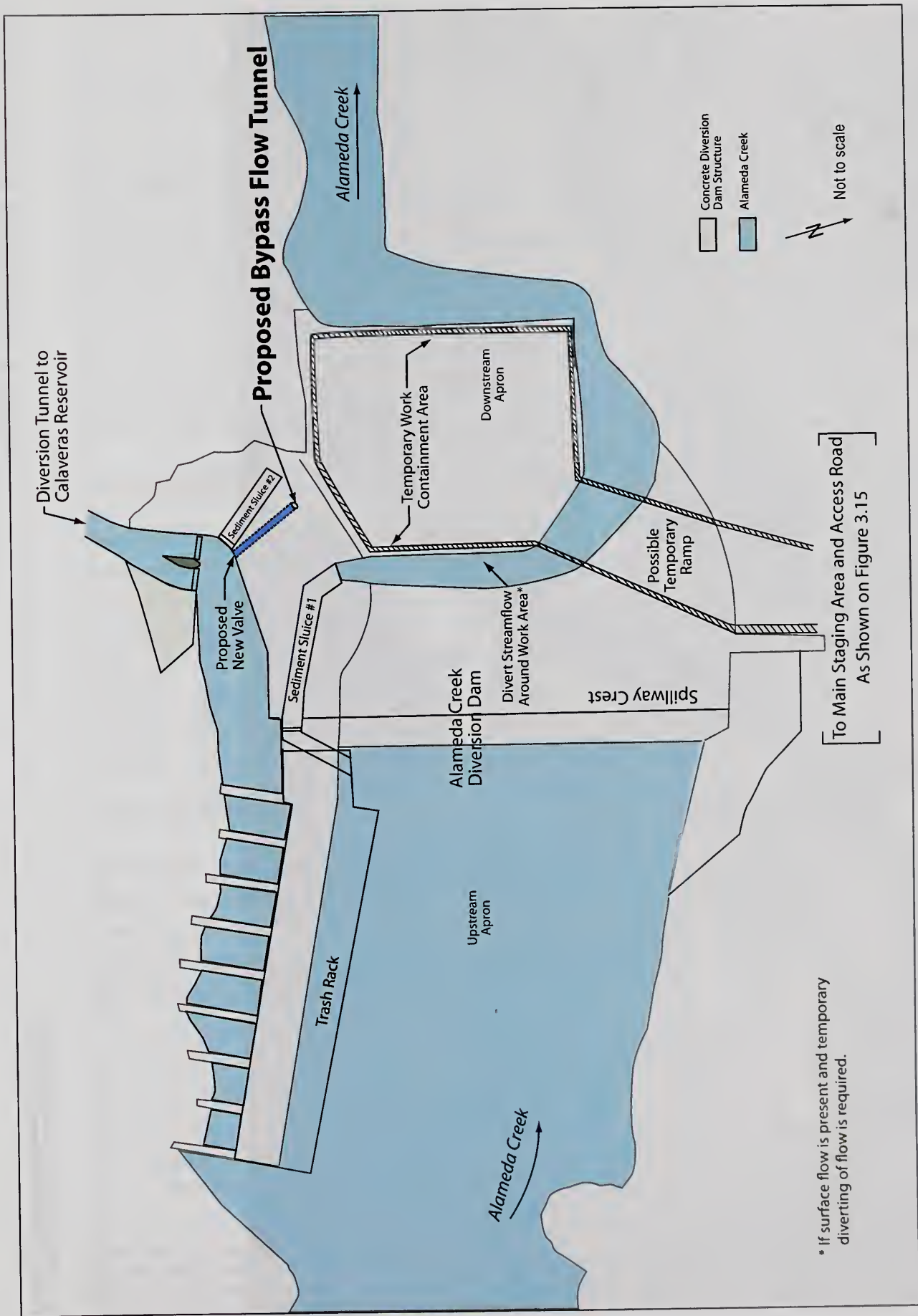
3.5.2 CONSTRUCTION OF ALAMEDA CREEK DIVERSION DAM BYPASS FACILITY

The Alameda Creek Diversion Dam Bypass Facility would consist of a bypass tunnel through the ACDD abutment and a gate to control bypass flows (see Figure 3.14: Proposed Bypass Tunnel at Alameda Creek Diversion Dam). A bypass tunnel approximately 20 feet long would be drilled horizontally through the left side (facing downstream) of the ACDD. The tunnel diameter would be approximately 30 inches. The bypass tunnel would be steel-lined to protect against erosion, and it would be located behind the existing trash rack at the ACDD to protect it from being blocked by debris. The bypass tunnel would be located adjacent to the existing sluice tunnel that is used to purge accumulated sediment at the ACDD. A manually-operated sluice gate would be installed on the upstream end of the tunnel. Flow through the tunnel would discharge into Alameda Creek immediately below the ACDD.

Concrete core-drilling equipment would be transported to the site along with scaffolding, generator, water supply equipment, and other supporting tools and materials. A staging area (approximately ¼ acre) would be created near the ACDD adjacent to the north side of the dam spillway and access gallery (see Figure 3.15: Proposed Bypass Tunnel Staging Area At Alameda Creek Diversion Dam). Construction workers would also park at this location. The staging area would include a temporary containment berm to retain any spills of diesel fuel or other construction materials. Equipment and materials would be moved between the staging area and the work area by either using a truck-mounted crane or constructing a temporary ramp.

The temporary work containment area to drill the proposed tunnel would be located on the downstream side of the ACDD due to space limitations on the upstream side. The containment area would include facilities for storage and containment of drilling waste (disposal would be off-site). Scaffolding and rigging for the drilling operation would be located entirely within the containment area. Alameda Creek would be used as the construction water supply unless prohibited by permit conditions. A screened pump intake would be placed directly into the creek immediately downstream of the work area. Alternatively, a water truck could be used as the water supply. Power would be provided by a trailer-mounted, diesel-powered generator located in the staging area; power would be delivered to the drill site by a temporary cable.

The majority of drilling activity would be conducted from the temporary work containment area. Drilling would be performed using a core drill of sufficient size to drill the selected diameter hole. Water quality in Alameda Creek would be protected by the temporary work containment area and collection and removal of the drilling waste to prevent release of concrete and rock drilling materials into the creek.



SOURCE: URS

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.14: PROPOSED BYPASS TUNNEL
AT ALAMEDA CREEK DIVERSION DAM



SOURCE: URS

CALAVERAS DAM REPLACEMENT PROJECT

**FIGURE 3.15: PROPOSED BYPASS TUNNEL
STAGING AREA AT ALAMEDA CREEK DIVERSION DAM**

The new bypass tunnel steel liner would be joined to the new gate structure on the upstream end of the tunnel. The space between the liner and the borehole would be grouted.

Dry testing would be conducted to demonstrate that the gate could be set and held in a particular open position. Wet testing would be conducted when the flow in Alameda Creek reaches the tunnel opening. Depending on the timing of the onset of the rainy season, this could be several months following completion of construction. Scaffolding and all other construction equipment and materials would be removed from the site. All drilling and construction waste would be contained and removed from the site for disposal at an off-site location in an appropriate manner.

Construction of the ACDD Bypass Facility is expected to take approximately 2 to 3 weeks. No more than eight construction workers would be on the site on a typical day to perform the drilling and sluice gate installation. No more than eight vehicles would arrive at the site each day.

3.5.3 SFPUC STANDARD CONSTRUCTION MEASURES FOR WSIP PROJECTS

The SFPUC has established Standard Construction Measures (SFPUC 2007b) for all WSIP projects that would be implemented as part of this project. The main objective of these measures is to reduce impacts on existing resources to the extent feasible. They include activities such as early identification of sensitive environmental resources in the WSIP project area and notifying businesses, owners, and residents of adjacent areas potentially affected by the WSIP projects about the nature, extent, and duration of construction activities. The SFPUC project manager, environmental project manager, and contract manager would ensure that the project contains uniform provisions to address these issues.

3.5.4 GREENHOUSE GAS REDUCTION ACTIONS

The proposed project would result in emission of greenhouse gases (GHG) that may contribute to global climate change. The SFPUC is committed to the following GHG reduction actions as part of the proposed project. The SFPUC will include the first two measures in all contractor specifications and implement the third measure during project planning and design, which would help reduce GHG emissions and provide other environmental benefits:

- a. The SFPUC will require that all contractors maintain tire inflation to the manufacturer's inflation specifications.
- b. The SFPUC will implement a construction worker education program.¹⁹
- c. The SFPUC will incorporate all applicable energy efficiency measures into the project design. For project buildings, the SFPUC will attempt to maximize energy efficiency by exceeding Title 24 minimum requirements by at least 20 percent. The SFPUC will

¹⁹ The education program could include such things as limiting idle time of construction equipment, using low-sulfur diesel fuels in construction equipment, regular maintenance of construction equipment, tire inflation, and using grid power whenever feasible to avoid on-site generators.

attempt to meet or exceed LEED Silver certification as required by the City's Green Building Ordinance.

3.5.5 CONSTRUCTION SCHEDULE

The estimated duration of construction would be approximately 4 years. In the first construction season, which would be in 2011 assuming Notice to Proceed is issued to the contractor in spring of that year, work would primarily include:

- Mobilization (e.g., site preparation, establishing staging areas);
- Demolition of existing site facilities (exclusive of the dam);
- Preparing the haul roads and access roads;
- Stabilizing the right abutment landslide;
- Constructing the dikes for Disposal Sites 3 and 7;
- Excavating the stilling basin, and placement of the excavated materials in disposal sites;
- Importing 20,800 cubic yards of filter and drain materials for Disposal Sites 3 and 7 finger drains;
- Starting excavation of the dam foundation;
- Excavating the intake shaft and adits; and
- Implementing temporary wintertime stabilization measures each year.

In the second construction season, assumed to be 2012, work would primarily include:

- Excavating the lower left abutment trench;
- Excavating the dam foundations,
- Constructing the intake shaft and tower;
- Constructing the stilling basin;
- Constructing the crest electrical building;
- Interconnecting the old and new intake shafts and connecting to outlet conduit;
- Start importing 298,300 cubic yards of filter and drain materials for dam construction; and
- Constructing the west shore haul route.

In the third construction season, assumed to be 2013, work would primarily include:

- Importing filter and drain materials for dam construction;
- Excavating the upper left abutment trench;
- Preparing the core and shell foundations and grouting;
- Beginning excavation of the spillway foundation;
- Starting construction of the spillway chute; and

- Constructing the replacement dam up to Elevation 655 feet.

In the fourth construction season, assumed to be 2014, work would primarily include:

- Complete importing filter and drain materials;
- Constructing the spillway;
- Completing construction of the embankment;
- Excavating the channel in the existing dam;
- Installing the instrumentation;
- Installing plantings and restoring construction areas;
- Constructing permanent access roads and repaving the dam access road; and
- Repaving Calaveras Road.

The ACDD bypass facility would be constructed in a low-flow period sometime during the 4-year construction period for the CDRP. In most years, the Alameda Creek bed at the ACDD is dry during summer.

Construction activity would generally consist of two 10-hour shifts per day, 6 days per week. The major earth-moving activities would follow this schedule, except blasting, which would be restricted to Monday through Friday. Refueling and lubrication of the equipment would occur between shifts 6 days per week. Equipment maintenance and repair would occur at various times 24 hours per day, 7 days per week. Underground excavation for the intake shaft and adits would be done in two or three 8-hour shifts per day, 6 days a week. Hauling of materials from off site may occur during weekdays from 7 a.m. to 5 p.m., or may occur at night. If at night, hauling would likely occur between 5 p.m. and 7 a.m. Monday through Friday. Importing off-site materials (sand and gravel) for dam construction would start in winter 2012 and would last about 18 months.

Each year, fill placement (and borrow) operations would occur during a 9-month construction season (approximately from spring to the end of the year). Foundation excavation operations could proceed year-round. Construction of the dam embankment would require about 24 months. Rockfill placement in the upstream shell of the dam could proceed during the winter months. Other operations, such as foundation grouting and concrete and mechanical work associated with the spillway and intake shaft, could occur over an approximately 3-year construction period.

The number of workers on the site would vary, as shown in Table 3.6.

Table 3.6: Number of Construction Workers by Time Period

Time Period	Number of Workers (approximate)	
	Day	Night
Spring 2011	70	10
Summer and fall 2011	100	20
Winter 2011	70	20
Spring 2012	70	20
Summer and fall 2012	100	20
Winter 2012	75	20
Spring, summer, and fall 2013	130	50
Winter 2013	90	20
Spring, summer, and fall 2014	140	50
Winter 2014	70	20

3.5.6 OPERATION OF THE RESERVOIR DURING CONSTRUCTION

During construction of the replacement dam, the reservoir would continue to operate in a manner similar to the current restricted operations, with the water level maintained between Elevation 690 and 705 feet (URS 2005b, p. 7-12). It would be operated to beneficially use the natural inflow whenever possible and to release water as necessary to Calaveras Creek to maintain the reservoir within these limits. There would be two consecutive shutdowns of the outlet works during construction (approximately mid-April to mid-November in either 2011 and 2012 or 2012 and 2013) to allow excavation of the dam foundation and extension of the outlet conduit, and to connect the new intake shaft to the outlet conduit. With no outlet available during these periods, and no operational spillway, it would be imperative that the reservoir be able to safely accommodate potential runoff. This means that the reservoir would need to be close to Elevation 690 feet when the outlet is taken out of service to accommodate any summer runoff (expected to be low during the shutdown period). The exact elevation would be determined based on the flow in Arroyo Hondo and Calaveras Creeks immediately before the outlet is shut down. These shutdowns would be scheduled to maintain an operational outlet during the rainy season (approximately mid-October through mid-April). The existing dam would be maintained in a condition such that it could safely retain an inflow equivalent to the 100-year storm event* (reservoir Elevation 738 feet) until the replacement dam is completed.

During construction, diversions from Alameda Creek would be limited to avoid excess storage and potential inundation of the haul road to Borrow Area E.

3.6 PROJECT OPERATION

Filling of the reservoir would begin following the final construction season, after the proposed project construction is complete. The reservoir would be filled by natural runoff from the watershed drainage area above Calaveras Reservoir and from upper Alameda Creek diversions at the ACDD. The primary sources of inflow are from Arroyo Hondo and Calaveras Creek. Water is diverted by the ACDD to Calaveras Reservoir when needed to meet target supply levels. A reservoir fill plan would be developed by SFPUC and a permit issued by DSOD to ensure that the dam can be monitored for safety reasons as it is refilled. It is expected that reservoir filling would include one or two 7-day reservoir-level hold stages to monitor conditions within the dam and foundation during the filling.

The time to fill the reservoir to its planned storage capacity of 96,850 AF is dependent upon the combination of natural inflow and SFPUC needs and could take from one to several years. Under current DSOD restrictions, a minimum of approximately 30,000 AF and a maximum of 38,100 AF of water are maintained in the reservoir. With a total capacity of 96,850 AF, it would take between 58,750 and 66,850 AF of net new storage to fill the reservoir.²⁰ Factors that would determine the length of time to refill the reservoir are:

- Inflow from the Calaveras Creek/Arroyo Hondo watersheds (approximately 36,000 AFY in a normal hydrologic year type);
- Diversion from the Alameda Creek watershed (approximately 6,000 AFY in a normal hydrologic year type);
- Outflow to the SVWTP to meet water supply needs (approximately 5,600 AF during reservoir refilling operations);
- Fishery releases to Alameda and Calaveras Creeks (up to 6,300 AFY); and
- Evaporation losses (approximately 2,500 AFY).

Refilling would be quicker if the SFPUC is able to meet more of its SVWTP needs from other sources. SFPUC's goal would be to limit outflow from the reservoir until full reservoir storage is restored. Nevertheless, it is likely that water supply withdrawals to the SVWTP would continue as needed throughout the filling period to meet SFPUC customer demand. Releases would be made to meet minimum streamflow requirements and to meet SFPUC needs throughout the year. Diversions from the ACDD would be similar to pre-DSOD restriction operations. However, as further discussed under Sections 3.6.5, Resident Rainbow Trout Flow Releases, and 3.6.6, Steelhead Flow Releases, below, flows to support native fishes would be provided through the proposed ACDD bypass tunnel.

²⁰ As noted, due to sediment accrual at the reservoir the effective storage is estimated at about 92,000 acre-feet. While the new dam would be moved northerly of the existing dam, only a minimal increase in storage capacity (several hundred acre-feet) would result.

3.6.1 LOCAL RESERVOIRS

Calaveras Reservoir would be operated similarly to pre-DSOD restricted operations, and in the same manner that other SFPUC local reservoirs are operated. The SFPUC's Regional Water System is heavily dependent upon reservoir storage. Local reservoirs would continue to be operated to maximize the use of local watershed runoff for annual water deliveries, drought supply, and emergencies. Water stored for later use is referred to as "carryover storage."

Because runoff is highly variable both seasonally and from year to year, carryover storage is an important component of the Regional Water System operations. During periods when demand is greater than runoff, stored water is needed to supplement direct runoff to meet demand. When demand is lower than available runoff, the runoff can be directly used for demand and any remaining runoff is stored for later use. Because the period of greatest runoff (winter) and the period of greatest demand (summer) are at different times of the year, water is stored when it is available from runoff and carried over to meet demand.

In general, the reservoirs are operated to enter the summer at the highest operating elevation (for CDRP, Elevation 756.2 feet). During summer, demand lowers the reservoirs, and as fall approaches the reservoirs are lowered to a level referred to as a "winter buffer," which will allow for regulation of runoff from winter storms. Winter and spring storm runoff is regulated by the reservoirs through delivery of water to meet demand and, if necessary, by additional releases to the streams below the reservoir dams (e.g., Calaveras Creek). In late winter and early spring, water is again stored in an attempt to enter the summer at the highest operating elevation.

3.6.2 CALAVERAS RESERVOIR OPERATIONS

After the reservoir is refilled, Calaveras Reservoir would be operated in accordance with established objectives by keeping the water elevation near the spillway crest at an elevation of 756.2 feet. Although the reservoir capacity would remain unchanged by the project, the reservoir would be kept, on average, fuller for longer periods than under pre-DSOD restriction conditions as a result of WSIP system improvements. This storage would provide sufficient supply during system maintenance activities (e.g., scheduled pipeline inspections) and would support system reliability during droughts (see further discussion in Subsection 3.2, Project Purpose and Objectives). In times of drought or when other Regional Water System supply is unavailable due to planned shutdowns for system maintenance, or unplanned shutdowns (facility upset), water stored in Calaveras Reservoir would be used to meet demand. During such times, water stored in the reservoir would be drawn down further than under normal operations, resulting in reduced reservoir storage. Following these periods, the reservoir would be refilled during the subsequent rainy season(s) to reach the highest operating elevation entering into the summer.

The ACDD would be operated similar to pre-DSOD restriction conditions, namely, the diversion gates would be opened at the beginning of the wet season and closed at the beginning of the dry

season. However, the SFPUC will prepare an ACDD Operations Plan, as part of the CDRP, which directs that the diversion dam and tunnel be operated to pass flows down Alameda Creek when diversion of those flows is not required to maintain desired levels in Calaveras reservoir. There would be a decrease in average annual diversions from Alameda Creek compared to diversions under current DSOD-restricted operations; as further discussed under Sections 3.6.5, Resident Rainbow Trout Flow Releases, and 3.6.6, Steelhead Flow Releases, below, flows to support native fishes would be provided through the proposed ACDD bypass tunnel whenever flow is available in upper Alameda Creek. Additional releases from Calaveras Reservoir to support native fishes would also occur pursuant to the 1997 MOU during periods when colder water is needed in Alameda Creek, and when flows are not available at the ACDD. (See further discussion in Section 4.6, Hydrology.)

As stated above, the capacity of the reservoir would not change from that under pre-DSOD restrictions; with WSIP system improvements the reservoir would be maintained at or near capacity for longer periods. Similar to pre-DSOD-restricted operations, when the reservoir water level approaches the spillway elevation, the cone valve would be opened in anticipation of the spill and would remain open during the spill event. The higher water level would create greater surface area and thus would increase evaporation losses by an estimated 5 AFY (approximately 0.002 percent).

Staff needed for operation and maintenance of the dam and reservoir would be the same as at present, i.e., a resident watershed keeper and daily visits by a crew dispatched from SVWTP.

3.6.3 CONE VALVE OPERATIONS

Under DSOD safety regulations, the SFPUC is required to exercise (operate) the 72-inch cone valve to demonstrate the ability to draw down the reservoir during an emergency. Accordingly, the SFPUC releases water from the reservoir through the cone valve at least every two to three years. Releases are made either to maintain the reservoir level below the spillway elevation as part of normal operations or, if operational releases are not needed for an extended period, releases are made for testing purposes only. The cone valve can also be tested by operating valves without releasing water. This allows demonstration that the equipment is functioning properly. The SFPUC exercises the cone valve without releasing water from the reservoir at least once per year.

As discussed above, during the CEQA baseline period, the SFPUC released approximately 37,385 AF of water to Calaveras Creek through the cone valve between December 2001 and February 2002, 33,574 AF from March 2005 through May 2005, and 65,402 AF from March 2006 through June 2006 to comply with the DSOD-restricted reservoir operation level. Water has not been released through the cone valve since July 2006.

As part of the CDRP, the SFPUC proposes to implement a Cone Valve Operations Plan requiring flow rates and cone valve releases to be timed to the maximum extent feasible to avoid or minimize adverse impacts on native fish, California red-legged frog, and foothill yellow-legged frog (see Sections 4.4, Vegetation and Wildlife, and 4.5, Fisheries and Aquatic Habitat). Except in the case of an emergency, cone valve releases would be made in September through November. Releases in June through August and November through December, although less desirable for salmonids, would be allowed under the Cone Valve Operation Plan when necessary, such as in response to an emergency that requires lowering the reservoir, or to manage the water level in response to atypical summer or early winter storms. Limiting cone valve releases to periods outside of the spring spawning season would reduce adverse impacts of releases on native fish and amphibians. This operations plan will implement WSIP Final Program EIR (PEIR) Mitigation Measure 5.4.6-3 Operational Procedures for Calaveras Dam Releases.

3.6.4 ALAMEDA CREEK DIVERSION DAM OPERATIONS

As part of the CDRP, the SFPUC will establish and implement written operational criteria for the ACDD that directs that the diversion dam and tunnel be operated to pass flows down Alameda Creek when diversion of those flows is not required to maintain desired levels in Calaveras Reservoir, to provide the maximum possible days of winter and spring flows in Alameda Creek below the ACDD. This operations plan will implement WSIP Final PEIR Mitigation Measure 5.4.1-2: Diversion Tunnel Operation.

3.6.5 RESIDENT RAINBOW TROUT FLOW RELEASES

SFPUC is required by the 1997 MOU with the CDFG to release up to 6,300 AFY of water for enhancement of fisheries and the other natural resources of the creeks.²¹ Operation of the ACDD bypass tunnel would be the primary means of providing rainy season releases for fish identified in the 1997 MOU; however, releases from Calaveras Dam still would be required to meet flow and temperature requirements, particularly in summer. To meet the MOU total flow of 6,300 AFY, and seasonal flow and ramping requirements, winter and spring flows would be met to the extent possible by allowing sufficient water to flow through the ACDD bypass tunnel. Releases would be made from the proposed ACDD bypass tunnel when there is sufficient flow in upper Alameda Creek to meet the MOU flow rate and schedule at the compliance point just below the confluence of Alameda Creek and Calaveras Creek. All flows in upper Alameda Creek are natural, that is, there is no storage facility above the ACDD and the ACDD itself provides no storage of note. Thus, when bypass flows available from upper Alameda Creek do not meet the level required by the MOU, flow would be supplemented as necessary with releases from Calaveras Dam, using the proposed new low-flow valves that would be installed there for this purpose. The resulting flow

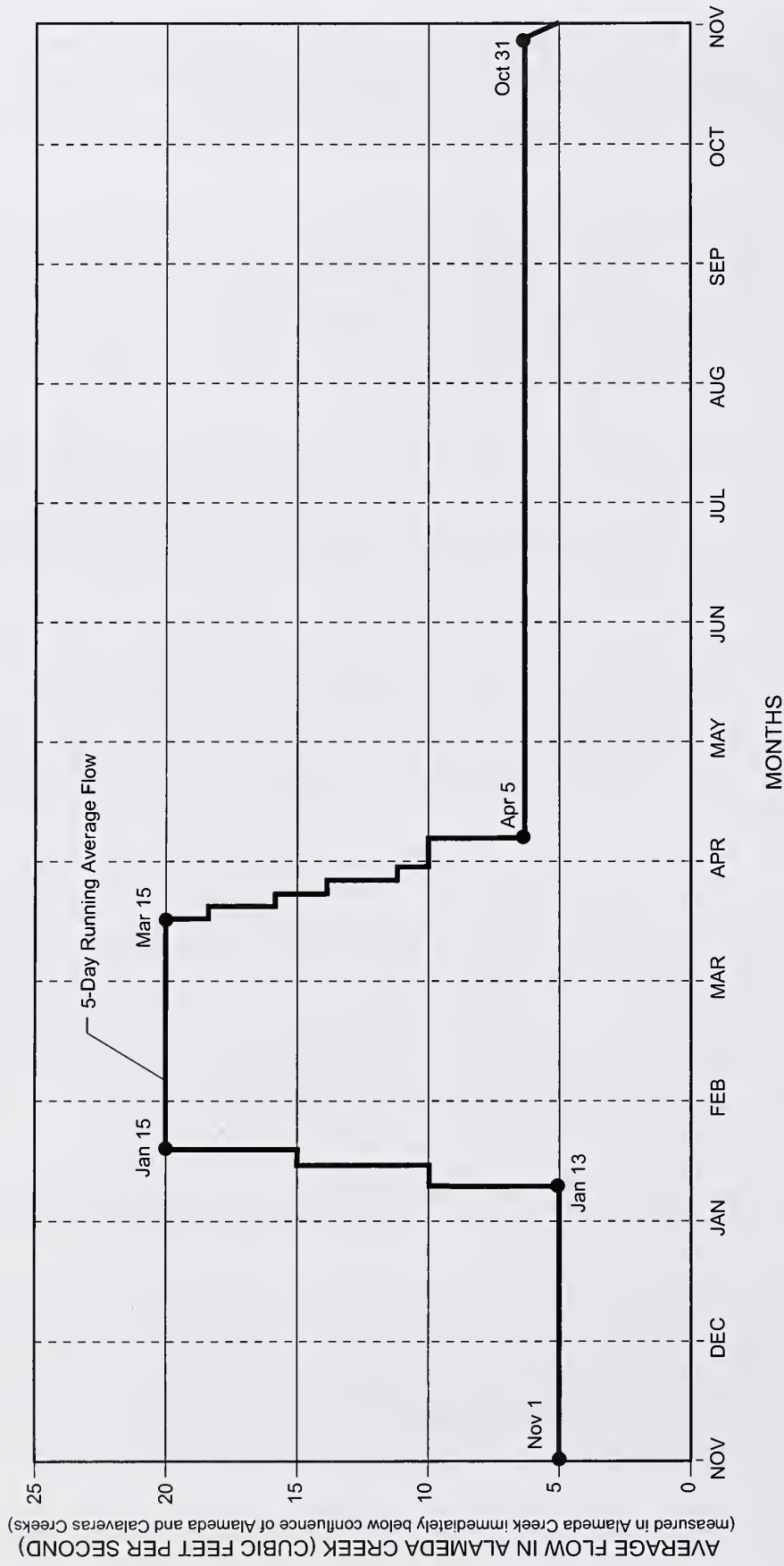
²¹ The measuring point for compliance with the 1997 MOU's flow requirements is Alameda Creek immediately below the confluence with Calaveras Creek.

regime would be consistent with that prescribed in the MOU (see Appendix H). When flows at the confluence of Alameda and Calaveras Creeks exceed the minimum flow requirements, up to 650 cfs would be diverted from Alameda Creek through the diversion tunnel into Calaveras Reservoir.

Under the 1997 MOU, there would be three primary flow regimes. The flow rate would be low during the fall, then increase beginning in January each year and remain high through the winter. In spring, the flow rate would diminish from March to April and remain at the same level until decreasing again at the end of the following October. This flow regime is shown in Figure 3.16: Proposed CDFG MOU Flow Releases. The proposed bypass flow regime would be as follows:

- Provide a 5-day running average flow of 5 cfs immediately below the confluence of Alameda and Calaveras Creeks from November 1 through January 14, with a minimum flow of not less than 4.5 cfs, except as modified by the ramping schedule set forth in Appendix 2 of the MOU. During this period, a minimum of 4.5 cfs and an average of 5 cfs would be derived from the ACDD bypass at all times when this flow is available in upper Alameda Creek.
- Provide a 5-day running average spawning flow of 20 cfs immediately below the confluence of Alameda and Calaveras Creeks from January 15 through March 15, with a minimum flow of not less than 18 cfs. The SFPUC shall ramp up to and down from the 20 cfs average spawning flow according to the stream flow schedule as described in Appendix 2 of the MOU. During this period, a minimum of 18 cfs and an average of 20 cfs would be derived from the ACDD bypass at all times when this flow is available in upper Alameda Creek.
- Provide a 5-day running average flow of 7 cfs immediately below the confluence of Alameda and Calaveras Creeks from March 16 through October 31, with a minimum flow of not less than 6.3 cfs, except as modified by the ramping schedule set forth in Appendix 2 of the MOU. During this period, a minimum of 6.3 cfs and an average of 7 cfs would be derived from the ACDD bypass at all times when this flow is available in upper Alameda Creek. It is recognized, however, that natural flows in Alameda Creek are very low in summer and often dry up entirely, and the available water may not be cool enough to meet fish habitat minimum temperature requirements; thus, summer flows would be provided primarily by releases from Calaveras Dam.
- This flow regime may be modified in the future through implementation of the Alameda Watershed Habitat Conservation Plan (discussed in Section 4.5, Fisheries and Aquatic Habitat).

Currently, there are no regularly scheduled releases to Calaveras Creek with the exception of periodic testing of the cone valve. There is some seepage through the dam and through the geologic formations under and around the dam. Releases occur when it is necessary to lower the reservoir level to accommodate inflow during the winter and spring rainy seasons, and for occasional maintenance. Under these operating conditions, the year-round flow in Calaveras



SOURCE: ED&W&T/turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 3.16: PROPOSED CDFG MOU FLOW RELEASES

Creek immediately below Calaveras Reservoir is about 0.5 cfs (1 AF per day) (Bookman-Edmonston 1995, p. 1-1). The 1997 MOU requires that, in addition to the release of up to 6,300 AFY, SFPUC maintain the existing base flow*rate of 0.5 cfs in Calaveras Creek above its confluence with Alameda Creek.²²

The 1997 MOU also requires that SFPUC maintain historical Calaveras Reservoir stratification conditions (see Subsection 3.3.4.5, Reservoir Limnology). Several studies have shown that instream flows and water temperature are the principal factors limiting native trout populations in Alameda Creek. Temperature stratification of Calaveras Reservoir has historically provided a cold-water pool when Calaveras Reservoir storage is more than 30,000 AF in the late summer (CDFG 1997). Release of this cold water during the summer months is necessary for the survival of trout in Calaveras and Alameda Creeks. Accordingly, the 1997 MOU requires that the SFPUC use its best efforts to maintain a minimum storage of 30,000 AF from July through late October. Adherence to this requirement would be part of the long-term operation of the dam.

3.6.6 STEELHEAD FLOW RELEASES

In addition to the flow release schedules proposed above for resident rainbow trout, the SFPUC proposes to implement the instream flow schedules specified in Table 3.7 below to support Central California Coast Steelhead spawning and rearing habitat (steelhead flow schedules). The steelhead flow schedules will be implemented when steelhead have regained access above the BART weir and the National Marine Fisheries Service (NMFS) has determined that steelhead have access to the Upper Alameda Creek Watershed. The proposed steelhead flow schedules are designed to provide suitable cold water habitat conditions for steelhead spawning and rearing in Calaveras and Alameda Creeks below the Calaveras Dam and the ACDD and are further described in Appendix J. The steelhead flow schedules proposed under this improvement measure represent the *minimum* flow releases that the SFPUC is committed to providing for steelhead as part of the CDRP. The steelhead flow schedules are subject to approval by NMFS in accordance with the Federal Endangered Species Act (FESA), and may therefore be modified through the federal permitting process.

²² The 1997 MOU also included provision for a recapture* facility below Calaveras Dam at the SVWTP. The proposed project does not include provision for a recapture facility. Such a facility is proposed and would be funded separately under the SFPUC's Water Supply Improvement Program (SFPUC 2005). It is included in the discussion of cumulative impacts in Chapter 6.

Table 3.7: Summary of Proposed Instream Flow Schedules for Steelhead^{1,2}

Flow Schedule Decision Date	Flow Schedule Application Date	Dry (Schedule C)		Normal (Schedule B)		Wet (Schedule A)	
		Cumulative Flows for Water-year Classification (MG)	Flow Requirement (cfs)	Cumulative Flows for Water-year Classification (MG)	Flow Requirement (cfs)	Cumulative Flows for Water-year Classification (MG)	Flow Requirement (cfs)
N/A	Oct	N/A	7	N/A	7	N/A	7
N/A	Nov – Jan 11	N/A	5	N/A	5	N/A	5
Jan 11	Jan 12 – Jan 31	< 1166	20*	1166 – 3660	20*	>3660	42*
Jan 31	Feb 1 – Feb 28	< 2597	20	2597 – 6882	20	>6882	42
Feb 28	Mar 1 – Mar 31	< 5721	20*	5721 – 11859	20*	>11859	42*
Mar 31	Apr 1 Apr 30	< 6563	7*	6563 – 17449	15*	>17449	32-18*
Apr 30	May 1 – May 31	< 7246	7	7246 – 18211	15	>18211	15
May 31	Jun 1 – June 30	< 7838	7	7838 – 18551	15	>18551	15
Jun 30	July 1 – Sept 30	< 7948	7	7948 – 78693	15	>18693	15

MG = million gallons; cfs = cubic feet per second; N/A = not available.

Notes:

¹ In addition to releases/bypasses in the table above, the SFPUC shall provide a bypass of up to 10 cfs downstream of the ACDD from December 1 to April 30 when sufficient stream flow is generated by precipitation events. This bypass will be implemented immediately upon completion of project construction.

² In addition to the releases/bypasses in the table above, the SFPUC shall provide a release of a minimum of 2 cfs, as measured at the Calaveras Creek USGS gage (USGS 11173500), from Calaveras Dam. This release will be made regardless of the time of year and other flow schedules. This release will be implemented immediately upon completion of project construction.

* with ramping

Source: SFPUC 2009b

3.7 DISCRETIONARY APPROVALS AND AGENCIES INVOLVED

3.7.1 CALIFORNIA ENVIRONMENTAL QUALITY ACT

Under the San Francisco Administrative Code, Chapter 31, the San Francisco Planning Department is responsible for implementing the California Environmental Quality Act (CEQA) for all projects undertaken by the City and County of San Francisco. The City and County of San Francisco is the Lead Agency for this EIR, and the project sponsor is the SFPUC. The Planning

Department's Major Environmental Analysis section (MEA) manages the preparation of CEQA documents. This document constitutes the Draft EIR for the proposed project.

This Draft EIR will undergo a 45-day public review period, including one public hearing in the East Bay on November 10, 2009 and in San Francisco on November 12, 2009 to obtain comments from the public and agencies on the Draft EIR. The public review period is from October 6, 2009 to November 20, 2009. Following the public review period, responses to written and oral comments received from the public and agencies will be prepared, and revisions to the Draft EIR text will be identified, if appropriate, based on these responses. The Comments and Responses document will be distributed to all commenters and to individuals requesting a copy. The San Francisco Planning Commission will consider certification of the Final EIR, comprised of the Draft EIR, revisions to the Draft EIR text, and the Comments and Responses document. Certification by the Planning Commission can be appealed to the San Francisco Board of Supervisors. Once certified, the EIR serves as one source of information to assist the SFPUC in determining whether to approve or modify the proposed project.

3.7.2 NATIONAL ENVIRONMENTAL POLICY ACT

Implementation of the project would require a Department of the Army individual permit to authorize the discharge of dredged or fill material into waters of the United States pursuant to section 404 of the Clean Water Act (CWA) from the San Francisco District, U.S. Army Corps of Engineers (USACE). The USACE will assess the environmental impacts of the proposed action in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA), the Council on Environmental Quality's Regulations (40 C.F.R. Parts 1500-1508), and the Corps' Regulations (33 C.F.R. Part 230 and Part 325, Appendix B).

3.7.3 AGENCY APPROVALS

The City and County of San Francisco Planning Department is the CEQA Lead Agency for the proposed project, and the certification of the Final EIR by the San Francisco Planning Commission would be a required approval.

The SFPUC would consider the certified Final EIR prior to consideration of approval of the proposed project and, if approved, the SFPUC would adopt CEQA findings and a Mitigation Monitoring and Reporting Program.

The San Francisco Board of Supervisors would consider appeals of EIR certification by the San Francisco Planning Commission. The San Francisco Board of Supervisors would also appropriate funding for implementation of the proposed project, including general obligation bond monies and annual budget appropriations.

In addition to CEQA, the proposed project would be subject to additional compliance and/or permitting requirements under state and federal regulations. Individual regulations, codes, and standards are described in Chapter 4, which evaluates the proposed project's impacts on specific environmental resources. The following federal, state, regional, or local permit approvals may be needed for the proposed project:

- CDFG
 - Streambed Alteration Agreement (also known as a 1602 Agreement) – CDFG regulates activities that would interfere with the natural flow of, or substantially alter, the channel, bed, or bank of a lake, river, or stream pursuant to California Fish and Game Code (“Code”) Section 1602.
 - A 2080/1 Agreement – Under Section 2080.1 of the Code, should the SFPUC receive authorization to take federally listed species under the federal Endangered Species Act (ESA), take authorization may also be sought as a “consistency determination” from CDFG. If CDFG determines that the federal statement or permit is not consistent with the California ESA (codified in Code Sections 2050 to 2097), the SFPUC would need to apply for a state incidental take permit under Section 2081(b) of the Code.
- San Francisco Bay Regional Water Quality Control Board (RWQCB)
 - Water Quality Certification (also known as a Section 401 certification) – Section 401 of the CWA requires an applicant (in this case the SFPUC), for any federal permit (e.g., a USACE Individual Permit), which may result in a discharge into waters of the U.S., to obtain a certification from the state that the discharge will comply with provisions of the CWA.
 - Waste Discharge Requirement (WDR) under the California Porter-Cologne Water Quality Control Act – The state regulates the discharge of waste (e.g., fill, any material resulting from human activity, or any other discharge) to waters of the state. A report of waste discharge must be filed with the San Francisco Bay RWQCB, which will then respond to the report of waste discharge by issuing WDRs in a public hearing, or by waiving WDRs (with or without conditions) for that proposed discharge.
 - NPDES Permits – The NPDES program is a federal permit program under the CWA that is administered by the San Francisco Bay RWQCB in the Bay Area. The program requires that any discharge of wastewaters to surface water needs a permit. The permits set limits on the quality of the wastewater and require monitoring. All permits are adopted in public hearings and are designed to protect the beneficial uses of the receiving waters. General NPDES storm water permits apply to any general ground-disturbing construction activity greater than 1 acre. The SFPUC or its contractor must submit a Notice of Intent to comply with the terms and conditions of this permit to the SWRCB and prepare a SWPPP. A SWPPP generally describes proposed construction activities, receiving waters, storm water discharge locations, and BMPs that would be used to reduce project construction effects on receiving water quality.

- USACE

As noted above, the project would require an Individual Permit under Section 404 of the CWA for the discharge of dredged or fill material into all waters of the United States, including wetlands. The application for a USACE permit will be reviewed for potential impacts to threatened or endangered species pursuant to Section 7 of the Endangered Species Act. If the USACE finds the proposed activity may affect an endangered or threatened species or their critical habitat, they are required to initiate formal consultation procedures with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service.

In processing a permit application the USACE will fulfill the requirements set forth in the National Historic Preservation Act (NHPA), other applicable historic preservation laws, and Presidential directives. The USACE will take into account the effects, if any, of proposed undertakings on historic properties both within and beyond the waters of the U.S. pursuant to Section 110(f) of the NHPA where the undertaking that is the subject of a permit action may directly and adversely affect any National Historic Landmark.

- U.S. Fish and Wildlife Service (USFWS) incidental take permit – Section 7 of the ESA requires the USACE to consult with USFWS to ensure that their actions are not likely to “jeopardize the continued existence” of any ESA-listed species or “result in the destruction or adverse modification” of designated critical habitat. Section 7 of the ESA allows USFWS to issue a Biological Opinion authorizing the incidental take of listed species if such take is accompanied by reasonable and prudent measures to minimize and mitigate impacts associated with the take. A Biological Assessment (used for formal Section 7 consultations) is being prepared concurrently with this EIR.
- National Marine Fisheries Service (NMFS) consultation – Section 7 of the ESA requires the USACE to consult with the NMFS. Section 7 allows NMFS to issue a Biological Opinion authorizing the incidental take of listed species if such take is accompanied by reasonable and prudent measures to minimize and mitigate impacts associated with the take. A Biological Assessment (used for formal Section 7 consultations) is being prepared concurrently with this EIR.
- National Historic Preservation Act (NHPA), Section 106 compliance – This section requires federal agencies (e.g., the USACE) to consider the effects of their actions on historic properties. Section 106 encourages, but does not mandate, preservation. The USACE is responsible for initiating Section 106 review with the State Historic Preservation Officer (SHPO). Section 106 review usually ends with a legally binding agreement that establishes how the federal agency would address the adverse effects, if historic properties would be harmed.
- Caltrans
 - Transportation Permit – for the movement of vehicles/loads exceeding statutory limitations on the size, weight, and loading of vehicles on state highways to the project site.
- California Department of Water Resources, Division of Safety of Dams
 - Approval of plans and specifications – DSOD reviews and grants approval to plans and specifications to construct or enlarge dams and reservoirs to ensure that no threat

to life or property could occur because of seepage, earth movement, or other types of reservoir-induced dam failures.

- Notice of completion and statement of actual cost; certificate of approval to impound water – DSOD evaluates the safety of newly constructed and enlarged reservoirs and grants approval to initiate storage operations.
- Construction approval, including referral to the Fish and Game Commission per Water Code Section 6500 for determination of need for fish ladder or screens in accordance with CDFG Code Sections 5933, 6020 – 6028.
- Bay Area Air Quality Management District (BAAQMD)
 - An “Authority to Construct” permit, which is issued after the BAAQMD engineers review a proposed project and determine that it is capable of complying with air quality laws and regulations. In addition, a Demolition or Renovation notification form would be submitted for demolition of structures potentially containing asbestos.
- California Department of Industrial Relations, Division of Occupational Safety and Health (Cal/OSHA)
 - A construction and tunneling permit, where construction includes trenches or excavations five feet or deeper and into which a person is required to descend; any building, structure, scaffolding, or falsework more than three stories high or the equivalent height (36 feet); demolition of any building or structure, or dismantling of scaffolding or falsework more than three stories high or the equivalent height (36 feet); or the erection or dismantling of vertical shoring systems more than three stories high, or the equivalent height (36 feet).
- Alameda County Sheriff
 - A permit to receive, store, transport, and use explosives.
- Alameda and Santa Clara Counties
 - Encroachment permits for work in county roads including proposed temporary road closures.

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4. ENVIRONMENTAL SETTING AND IMPACTS

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4.1 OVERVIEW

4.1.1 SCOPE OF ANALYSIS

The scope of environmental topics addressed in this EIR is based on the topics presented in the City of San Francisco Planning Department's Major Environmental Analysis (MEA) CEQA Checklist which, in turn, is generally based on the sample Environmental Checklist Form provided in *CEQA Guidelines* Appendix G, with some modifications to reflect issues of concern specific to San Francisco.

This chapter discusses the environmental setting and impacts of the proposed Calaveras Dam Replacement Project (CDRP) in relation to the following environmental topics: Plans and Policies; Land Use, Agricultural Resources, and Recreation; Vegetation and Wildlife; Fisheries and Aquatic Resources; Hydrology; Water Quality; Geology, Soils, and Seismicity; Hazards and Hazardous Materials; Cultural Resources; Visual Resources; Transportation and Circulation; Air Quality; Noise and Vibration; Utilities, Service Systems, and Public Services; and Mineral and Energy Resources.

As described in Chapter 2, Introduction and Background, the Planning Department published a Notice of Preparation (NOP) for the proposed project on October 24, 2005, and held two public scoping meetings on November 14 and 15, 2005 to provide information about the project and the EIR process, and to gather input that would assist the Planning Department in determining the

scope and content of the EIR analysis. Written comments and public testimony were received from agencies, organizations, and individuals. Comments and testimony were reviewed and considered in the preparation of this EIR and have informed the identification and analysis of environmental impacts.

4.1.2 CHAPTER CONTENT AND STRUCTURE

Each section of this chapter discusses the proposed project in relation to a different environmental topic as listed above. The Plans and Policies section identifies relevant local, regional, and agency plans and policies and discusses the consistency of the proposed project with local, regional, and agency plans and policies, as required by *CEQA Guidelines* Section 151259(d). Cumulative impacts are addressed in Chapter 6, Other Topics Required by CEQA.

Each subsequent environmental topic section is organized into two main subsections: Setting and Impacts.

4.1.2.2 SETTING

Under each environmental topic section, the Setting subsection describes the physical environmental conditions in the vicinity of the project, as these relate to the environmental topic. The description of environmental setting provides the baseline to which impacts under the proposed project will be compared. The Setting subsection also identifies the existing regulatory framework relevant to the environmental topic.

4.1.2.3 IMPACTS

Significance Criteria

In each topic section, the Impacts subsection begins by identifying the significance criteria by which the significance of project impacts will be analyzed and determined. The significance criteria in this EIR are based on the questions in the San Francisco Planning Department MEA CEQA Checklist, which is derived from the *CEQA Guidelines* Appendix G.

4.1.2.4 APPROACH TO ANALYSIS

The approach to analysis describes the assumptions made about the project for the purposes of analyzing project impacts (e.g., if there are applicable regulations requiring implementation of measures that could reduce a potential impact, the regulation is identified and compliance with the regulation is assumed for the purposes of analysis). This subsection also summarizes the topic-specific approaches used in the analyses of project impacts.

Project Impacts

Statement and Description of Impact

Project-specific impacts of construction and operation of the proposed project are identified by a numbered and boldfaced summary statement of the impact, followed by a detailed description of the location, nature and magnitude of the impact as called for by the topic. Each discussion of a project impact applies the relevant significance criteria to determine the significance of the impact under CEQA.

As part of the significance determination process, the analysis evaluates whether there are applicable non-discretionary requirements under local, state, or federal laws and regulations; San Francisco Public Utilities Commission (SFPUC) *Alameda Watershed Management Plan* policies; or Greenhouse Gas Reduction Measures (as described in Section 3.5.4 in Chapter 3, Project Description) that, if implemented, would ensure that the impact would not exceed significance thresholds. If so, compliance with such requirements as part of the project is assumed, and the impact is considered to be less than significant. If the physical change is identified as exceeding the applicable significance criterion and if no existing requirements apply to address the impact, or if applicable requirements are either discretionary or not detailed or comprehensive enough to ensure that the impact would be less than significant, then the impact is considered significant.

CEQA requires that an EIR identify feasible mitigation measures that would avoid or reduce the significant impact. If feasible mitigation is available, the measure is identified by reference to a specific mitigation measure (presented separately in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project).

Impact Conclusion and Significance Determinations

Each discussion of project impact concludes with a determination of the level of significance of the impact. An impact that is “less than significant” (LS) does not rise to the applicable significance threshold. No mitigation is required. An impact that is “less than significant with mitigation” (LSM) is one that would be reduced to a less-than-significant level with implementation of feasible mitigation measures, identified in Chapter 5. An impact that is “Significant and Unavoidable” (SU) is one for which implementation of feasible mitigation measures would still not reduce the impact to a less-than-significant level, or for which feasible mitigation measures are not available. Some impacts would be “beneficial” (B), and others would have “no impact” (NI).

The Impacts subsection for each topic section begins with a summary table that lists the impacts identified under the topic and the determination of significance for each impact.

4.1.3 ENVIRONMENTAL TOPICS EXCLUDED FROM FURTHER STUDY IN THIS EIR

An Initial Study was not prepared for the proposed project as it was clear from the outset that preparation of an EIR would be required. *CEQA Guidelines* Section 15060 provides that in the absence of an Initial Study, “the lead agency may still focus the EIR on the significant effects of the project and indicate briefly its reasons for determining that other effects would not be significant or potentially significant.”

In preparation of this EIR, the San Francisco Planning Department has considered impacts of the proposed project related to the topics of Wind and Shadow, and Population and Housing, and has determined that no potential for significant environmental effects exists in relation to these topics, as discussed below.

4.1.3.1 WIND AND SHADOW

Construction and operation of the proposed replacement dam, and refilling Calaveras Reservoir would not alter wind conditions or create new shadow in a manner that substantially affects public areas. Portions of the Alameda Creek watershed are open to the public for hiking or other types of recreation, such as those allowed in the Sunol Wilderness Regional Preserve. While public recreation areas are near the project site, the replacement structures proposed as part of the project, including the replacement dam and appurtenant structures, would not be large enough or tall enough to result in any measurable changes in existing wind conditions in any publicly accessible areas.

Therefore, no impacts related to Wind and Shadow could occur as a result of the proposed project. The topic of Wind and Shadow will not be discussed further in this EIR.

4.1.3.2 POPULATION AND HOUSING

Construction and operation of the proposed replacement dam, and refilling Calaveras Reservoir would not induce substantial population growth in an area; would not displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere; and would not displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

The Calaveras Dam and Reservoir are located within undeveloped watershed lands owned almost entirely by the SFPUC. As such, there are few residents, employed persons, or housing units in the project area. The existing residential population in the project vicinity consists of the SFPUC’s watershed keeper who resides in the watershed keeper’s complex located on the east shore of the reservoir. Minimal SFPUC staff is required to operate the existing dam and reservoir. The watershed keeper provides on-site surveillance and security. No other permanent

employees are located at the project site. A crew of existing staff stationed at the Sunol Valley Water Treatment Plant (SVWTP) visit the dam and reservoir on a daily basis (including weekends) to check facilities, conduct routine manual procedures, and monitor water quality. These activities would continue during construction and for the operational life of the project.

Construction of the CDRP would generate an average of 91 construction workers during each day shift throughout the construction period (approximately 4 years). The number of construction workers would vary from a minimum of 70 workers per day during the initial start-up, to a maximum of 140 workers during the peak activity period. The peak number of workers during the night shift generally would be 50 or fewer. It is expected that a majority of construction workers associated with the proposed project would already reside in the Bay Area. These workers would already be accommodated within the existing Bay Area housing supply. It is also expected that if any workers are newly attracted to the area by employment opportunities from construction of the proposed project, any increased housing demand would be absorbed within the existing Bay Area housing supply.

No additional permanent employment would be generated by the proposed project. After construction, it is expected that surveillance and security would be continued by the on-site watershed keeper, and that inspection and operation of the dam facilities would be continued by existing staff stationed at the SVWTP at existing levels. Construction of new access roads and improvements to existing roads within the project area would not result in any significant new development opportunities in the area as these would be used solely for construction purposes to provide access to existing SFPUC property and facilities.

For these reasons, no potentially significant impacts related to Population and Housing could occur as a result of the construction of the proposed project. The topic of Population and Housing will not be discussed further in this EIR.

The potential for indirect population growth related to improvements to SFPUC water supply facilities, from restored water storage in Calaveras Reservoir and cumulative effects from the increased water resources through the WSIP and other water supply projects, is discussed separately in Section 6.1, Growth Inducement.

4.1.3.3 WSIP WATER SUPPLY AND OPERATIONS STRATEGY IMPACTS AND MITIGATION

As discussed in Chapter 2, Introduction and Background, the proposed project, along with several other facility improvement projects, are components of the SFPUC's Water System Improvement Program (WSIP). The Program EIR (PEIR), which was certified by the San Francisco Planning Commission on October 30, 2008, addresses the potential environmental impacts of the WSIP

and evaluates regional water supply alternatives. Because the proposed project is a component of the WSIP, the project would also contribute to the WSIP's water supply impacts.

The PEIR analyzed potential water supply and system operations impacts (separate from environmental impacts associated with the facility improvements) within the following geographic regions: the Tuolumne River, Alameda Creek, and Peninsula watersheds, and the Westside Basin groundwater resources systems. The PEIR also identified the cumulative effects of implementing the WSIP and system operations in combination with other past, present, and reasonably foreseeable future projects within each of these watersheds. It also discussed the potential effects of climate change and global warming on the regional water system.

The WSIP would result in changes in reservoir levels and associated changes in downstream flows in rivers and creeks in the three affected watersheds, potentially resulting in impacts on groundwater, water quality, fisheries, and terrestrial biological resources. In the event that deliveries to customers exceed 265 mgd (average annual), streamflow changes in the Tuolumne River watershed could affect fisheries and terrestrial biological resources. In the Alameda Creek and Peninsula watersheds, the WSIP, which includes restoring the historical storage capacities of Calaveras and Lower Crystal Springs Reservoirs, could affect reservoir levels, downstream flows, fisheries, and terrestrial biological resources. In addition, similar to the originally proposed WSIP, the WSIP will develop groundwater supplies in the North Westside Groundwater Basin as well as a conjunctive-use program in the South Westside Groundwater Basin.

As stated above, the proposed project is a component of the WSIP, and therefore it would contribute to the WSIP's water supply impacts, shown in Tables 4.1.1 through 4.1.5, below. These tables summarize the WSIP water supply impacts and mitigation measures for each geographic region as analyzed in the PEIR. (See Table 4.1.2 for the WSIP PEIR-identified water supply impacts and mitigation measures for the Alameda Creek watershed, the watershed in which Calaveras Dam is located.)

In addition to water supply impacts and mitigation measures, the PEIR provides a program-level analysis of the impacts associated with facility improvement projects, including construction, cumulative construction, and operation impacts. This EIR addresses the same issues as the PEIR does for the proposed project, at a project-level detail. Also, to the extent affected by the CDRP, this EIR re-evaluates impacts analyzed as part of the PEIR water supply and system operations analysis for the Alameda Creek watershed. Appendix I of this project-level EIR presents a comparison of the programmatic mitigation measures identified for this project in the PEIR with the actual mitigation measures identified for this project in Chapter 5 of this EIR. This EIR tiers from the PEIR, and the analyses relevant to this proposed project are incorporated by reference into this EIR. All of the WSIP water supply impacts to which this project contributes have been examined in detail in the PEIR. No new, relevant information is available to augment that

analysis with the exception of the re-evaluation of impacts analyzed as part of the PEIR water supply and system operations analysis for the Alameda Creek watershed related to the CDRP as explained earlier in this EIR (see Chapter 2.0 Introduction and Background). The PEIR is available for public review at the San Francisco Planning Department, 1650 Mission Street, San Francisco, CA 94103, and is on the Planning Department's website at <http://www.sfgov.org/planning/mea>. The State Clearinghouse Number for the PEIR is 2005092026.

Table 4.1.1: Summary of Water Supply Impacts and Mitigation Measures in the WSIP PEIR – Tuolumne River System and Downstream Water Bodies

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
STREAM FLOW						
Impact 5.3.1-1: Effects on flow along the Tuolumne River below O'Shaughnessy Dam.	LS					None required.
Impact 5.3.1-2: Effects on flow along Cherry Creek below Cherry Dam.	LS					None required.
Impact 5.3.1-3: Effects on flow along Eleanor Creek below Eleanor Dam.	LS					None required.
Impact 5.3.1-4: Effects on flow along the Tuolumne River below La Grange Dam.	LS					None required.
Impact 5.3.1-5: Effects on flow along the San Joaquin River and the Sacramento–San Joaquin Delta.	LS					None required.
GEOMORPHOLOGY						
Impact 5.3.2-1: Effects on sediment transport and channel characteristics between O'Shaughnessy Dam and Don Pedro Reservoir.	LS					None required.

Table 4.1.1: (Tuolumne River System and Downstream Water Bodies - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
Impact 5.3.2-2: Effects on sediment transport and channel characteristics below La Grange Dam.	LS					None required.
SURFACE WATER QUALITY						
Impact 5.3.3-1: Effects on water quality in Hetch Hetchy Reservoir and along the Tuolumne River below O'Shaughnessy Dam.	LS					None required.
Impact 5.3.3-2: Effects on water quality in Don Pedro Reservoir and along the Tuolumne River below La Grange Dam.	LS					None required.
Impact 5.3.3-3: Effects on water quality along the San Joaquin River and the Sacramento-San Joaquin Delta.	LS					None required.
SURFACE WATER SUPPLIES						
Impact 5.3.4-1: Effects on Tuolumne River, San Joaquin River, and Stanislaus River water users.	LS					None required.
Impact 5.3.4-2: Effects on Delta water users.	LS					None required.

Table 4.1.1: (Tuolumne River System and Downstream Water Bodies - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
GROUNDWATER						
Impact 5.3.5-1: Alteration of stream flows along the Tuolumne River, which could affect local groundwater recharge and groundwater levels.	LS					None required.
Impact 5.3.5-2: Alteration of stream flows along the Tuolumne River, which could affect local groundwater quality.	LS					None required.
FISHERIES						
Impact 5.3.6-1: Effects on fishery resources in Hetch Hetchy Reservoir.	LS					None required.
Impact 5.3.6-2: Effects on fishery resources along the Tuolumne River between Hetch Hetchy Reservoir and Don Pedro Reservoir.	LS					None required.
Impact 5.3.6-3: Effects on fishery resources in Don Pedro Reservoir.	LS					None required.

Table 4.1.1: (Tuolumne River System and Downstream Water Bodies - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
FISHERIES (continued)						
Impact 5.3.6-4: Effects on fishery resources along the Tuolumne River below La Grange Dam.	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd					Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water: The SFPUC will pursue a water transfer arrangement with MID/TID and/or other water agencies which would offset the WSIP's effects on water storage in Don Pedro Reservoir and minimize WSIP-induced changes in releases from La Grange Dam.

Table 4.1.1: (Tuolumne River System and Downstream Water Bodies - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
FISHERIES (continued)						
Impact 5.3.6-5: Effects on fishery resources along the San Joaquin River.	LS					None required.
TERRESTRIAL BIOLOGY						
Impact 5.3.7-1: Impacts on riparian habitat and related biological resources in Hetch Hetchy Reservoir and along the bedrock channel portions of the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir.		LS	LS	LS	LS	None required.
Impact 5.3.7-2: Impacts on alluvial features that support meadow and riparian habitat along the Tuolumne River from O'Shaughnessy Dam to Don Pedro Reservoir.		PSM	PSM	PSM	PSM	The SFPUC will implement Measure 5.3.7-2 to reduce adverse impacts on sensitive habitats, key special-status species, other species of concern, and common habitats and species to a less-than-significant level.

Table 4.1.1: (Tuolumne River System and Downstream Water Bodies - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
TERRESTRIAL BIOLOGY (continued)						
						Measure 5.3.7-2, Controlled Releases to Recharge Groundwater in Streamside Meadows and Other Alluvial Deposits: The SPPUC will manage releases to the Tuolumne River from Hetch Hetchy Reservoir during the spring with the goal of recharging groundwater that supports meadow and riparian habitat. The SFPUC will periodically survey meadow habitat to determine the efficacy of release management and will modify releases as necessary to sustain meadow habitat.
Impact 5.3.7-3: Impacts on biological resources in Lake Eleanor and along Eleanor Creek.		LS	LS	LS	LS	None required.
Impact 5.3.7-4: Impacts on biological resources in Lake Lloyd and along Cherry Creek.		LS	LS	LS	LS	None required.
Impact 5.3.7-5: Impacts on biological resources in Don Pedro Reservoir.		LS	LS	LS	LS	None required.

Table 4.1.1: (Tuolumne River System and Downstream Water Bodies - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY (continued)						
Impact 5.3.7-6: Impacts on biological resources along the Tuolumne River below La Grange Dam.		LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	LS when average annual deliveries from the watersheds are maintained at 265 mgd or less; PSM if deliveries exceed 265 mgd	The SFPUC will implement Measures 5.3.6-4a or 5.3.7-6 to reduce adverse impacts on sensitive habitats, key special-status species, other species of concern, and common habitats and species to a less-than-significant level. Measure 5.3.6-4a, Avoidance of Flow Changes by Reducing Demand for Don Pedro Reservoir Water – see description above. **If Measure 5.3.6-4a proves to be infeasible, the SFPUC will implement Measure 5.3.7-6. Measure 5.3.7-6, Lower Tuolumne River Riparian Habitat Enhancement: Consistent with the Lower Tuolumne River Restoration Plan, the SFPUC will protect and enhance one mile of riparian vegetation within the contemporary floodplain.

Table 4.1.1: (Tuolumne River System and Downstream Water Bodies - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
TERRESTRIAL BIOLOGY (continued)						
Impact 5.3.7-7: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans for the Tuolumne Wild and Scenic River.		LS				None required.
RECREATIONAL AND VISUAL RESOURCES						
Impact 5.3.8-1: Effects on reservoir recreation due to changes in water system operations.	LS					None required.
Impact 5.3.8-2: Effects on river recreation due to changes in water system operations.	LS					None required.
Impact 5.3.8-3: Effects on the aesthetic values of the Tuolumne Wild and Scenic River.	LS					None required.
ENERGY RESOURCES						
Impact 5.3.9-1: Effects on hydropower generation at facilities along the Tuolumne River	B					None required.

Table 4.1.2: Summary of Water Supply Impacts and Mitigation Measures in the WSIP PEIR – Alameda Creek Watershed

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special Status- Species	Other Species of Concern		
STREAMFLOW						
Impact 5.4.1-1*: Effects on flow along Calaveras Creek below Calaveras Reservoir.	LS					None required
Impact 5.4.1-2*: Effects on flow along Alameda Creek below the diversion dam.	SU					Measure 5.4.1-2, Diversion Tunnel Operation: The SFPUC will implement operational criteria for the diversion dam which will require that water not needed to fill Calaveras Reservoir would be released to Alameda Creek below the diversion dam.
Impact 5.4.1-3: Effects in San Antonio Reservoir and along San Antonio Creek.	LS					None required.
Impact 5.4.1-4*: Effects on flow along Alameda Creek below the confluence of San Antonio Creek.	LS					None required.
GEOMORPHOLOGY						
Impact 5.4.2-1*: Effects on channel formation and sediment transport along Calaveras Creek.	LS					None required.

Table 4.1.2: (Alameda Creek Watershed - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special Status- Species	Other Species of Concern	Common Habitats and Species	
GEOMORPHOLOGY (continued)						
Impact 5.4.2-2*: Effects on channel formation and sediment transport along Alameda Creek downstream of the diversion dam and downstream of the San Antonio Creek confluence.	LS					None required.
Impact 5.4.2-3: Effects on channel formation and sediment transport along San Antonio Creek downstream of San Antonio Reservoir.	LS					None required.
SURFACE WATER QUALITY						
Impact 5.4.3-1*: Effects on water quality in Calaveras Reservoir.	LS					None required.
Impact 5.4.3-2: Effects on water quality in San Antonio Reservoir.	LS					None required.
Impact 5.4.3-3*: Changes in water quality along Calaveras, San Antonio, and Alameda Creeks.	LS					None required.
GROUNDWATER BODIES						
Impact 5.4.4-1*: Changes in groundwater levels, flows, quality, and supplies.	LS					None required.

Table 4.1.2: (Alameda Creek Watershed - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special Status- Species	Other Species of Concern	Common Habitats and Species	
FISHERIES						
Impact 5.4.5-1*: Effects on fishery resources in Calaveras Reservoir.	B					None required.
Impact 5.4.5-2*: Effects on fishery resources along Calaveras Creek below Calaveras Dam and along Alameda Creek below confluence with Calaveras Creek.	B					None required.
Impact 5.4.5-3*: Effects on fishery resources along Alameda Creek downstream of Alameda Creek Diversion Dam.	PSM					Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek: The SFPUC will release a minimum flow of approximately 10 cubic feet per second from the diversion dam and monitor the effects of the release on resident trout spawning and egg incubation. ** If monitoring results for Measure 5.4.5-3a indicate the measure is unsuccessful, the SFPUC will implement Measure 5.4.5-3b. Measure 5.4.5-3b, Alameda Diversion Dam Restrictions or Fish Screens: If after 10 years the minimum release does not sustain the resident trout population, the SFPUC will either increase releases from the diversion dam or install a fish passage barrier on the diversion tunnel.
Impact 5.4.5-4: Effects on fishery resources in San Antonio Reservoir.	B					None required.

Table 4.1.2: (Alameda Creek Watershed - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special Status-Species	Other Species of Concern		
FISHERIES (continued)						
Impact 5.4.5-5: Effects on fishery resources along San Antonio Creek below San Antonio Reservoir.	LS					None required.
Impact 5.4.5-6*: Effects on fishery resources along Alameda Creek below confluence with San Antonio Creek.	LS					None required.
TERRESTRIAL BIOLOGY						
Impact 5.4.6-1*: Effects on riparian habitat and related biological resources in Calaveras Reservoir.		PSM	PSM	LS	LS	The SFPUC will implement Measure 5.4.6-1 to reduce adverse impacts on sensitive habitats and key special-status species to a less-than-significant level. Measure 5.4.6-1, Compensation for Impacts on Terrestrial Biological Resources: The SFPUC will protect, restore, and enhance existing riparian habitat and/or create new habitat that compensates for WSIP-induced habitat losses at Calaveras Reservoir. Compensatory habitat may be provided as part of the SFPUC's Habitat Reserve Program.
Impact 5.4.6-2*: Effects on riparian habitat and related biological resources along Alameda Creek, from below the diversion dam to the confluence with Calaveras Creek.		LS	PSM	LS	N/A	The SFPUC will implement Measures 5.4.1-2 and 5.4.5-3a to reduce adverse impacts on key special-status species to a less-than-significant level. Measure 5.4.1-2, Diversion Tunnel Operation – see description above. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek see description above.

Table 4.1.2: (Alameda Creek Watershed - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special Status- Species	Other Species of Concern		
TERRESTRIAL BIOLOGY (continued)						
Impact 5.4.6-3*: Effects on riparian habitat and related biological resources along Calaveras Creek, from Calaveras Reservoir to the confluence with Alameda Creek.		LS	PSM	LS	LS	The SFPUC will implement Measure 5.4.6-3 to reduce adverse impacts on key special-status species to a less-than-significant level. Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases: The SFPUC will manage releases from Calaveras Reservoir to mimic a more natural hydrologic regime in the creek for the benefit of terrestrial biological resources. The specifics of this mitigation measure will be determined as part of project-level CEQA review.
Impact 5.4.6-4*: Effects on riparian habitat and related biological resources along Alameda Creek, from the confluence with Calaveras Creek to the confluence with San Antonio Creek.		LS	PSM	LS	LS	The SFPUC will implement Measures 5.4.6-3 and 5.4.5-3a to reduce adverse impacts on key special-status species to a less-than-significant level. Measure 5.4.6-3, Operational Procedures for Calaveras Dam Releases – see description above. Measure 5.4.5-3a, Minimum Flows for Resident Trout on Alameda Creek – see description above.
Impact 5.4.6-5: Effects on riparian habitat and related biological resources in San Antonio Reservoir.		LS	LS	LS	LS	None required.
Impact 5.4.6-6: Effects on riparian habitat and related biological resources along San Antonio Creek between Turner Dam and the confluence with Alameda Creek.		LS	LS	LS	N/A	None required.

Table 4.1.2: (Alameda Creek Watershed - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special Status-Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY (continued)						
Impact 5.4.6-7*: Effects on riparian habitat and related biological resources along Alameda Creek below the confluence with San Antonio Creek.		LS	LS	LS	N/A	None required.
Impact 5.4.6-8*: Conflicts with the provisions of adopted conservation plans or other approved biological resources plans.		LS				None required.
RECREATION AND VISUAL						
Impact 5.4.7-1*: Effects on recreational facilities and/or activities.	LS					None required.
Impact 5.4.7-2*: Visual effects on scenic resources or visual character of the water bodies.	LS					None required.

*Project-specific impacts that are re-evaluated in this EIR.

 Not applicable

Table 4.1.3: Summary of Water Supply Impacts and Mitigation Measures in the WSIP PEIR – Peninsula Watersheds

Impact		Significance Determination					Mitigation Measures
		All Impacts (except Biological Resources)	Biological Resource Impacts				
			Sensitive Habitats	Key Special-Status Species	Other Species of Concern	Common Habitats and Species	
STREAM FLOW							
Impact 5.5.1-1: Effects on flow along San Mateo Creek.		LS					None required.
Impact 5.5.1-2: Effects on flow along Pilarcitos Creek.		LS					None required.
GEOMORPHOLOGY							
Impact 5.5.2-1: Changes in sediment transport and channel morphology in the Peninsula watershed.		LS					None required.
WATER QUALITY							
Impact 5.5.3-1: Effects on water quality in Crystal Springs Reservoir, San Andreas Reservoir, and San Mateo Creek.		LS					None required.

Table 4.1.3: (Peninsula Watersheds - Continued)

Impact	Significance Determination				Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern	
WATER QUALITY (continued)					
Impact 5.5.3-2: Effects on water quality in Pilarcitos Reservoir and along Pilarcitos Creek.	PSM				Measure 5.5.3-2a, Low-head Pumping Station at Pilarcitos Reservoir: The SFPUC will install a permanent low-head pumping station at Pilarcitos Reservoir which would enable the SFPUC to access and use an additional 350 acre-feet of water from Pilarcitos Reservoir. In years when the WSIP would cause releases from Pilarcitos Reservoir to Pilarcitos Creek to be reduced to reservoir inflow earlier in the summer than under the existing condition (about 25 percent of years in the hydrologic record), the SFPUC will use the pumping station to augment flow in Pilarcitos Creek with water from the reservoir. The pumping station will draw water from the cool pool of water below the thermocline during times when the reservoir is stratified. The pumping station outlet will be designed to ensure that water discharged to the creek is adequately aerated. Measure 5.5.3-2b. Aeration System at Pilarcitos Reservoir: The SFPUC will install a permanent aeration system at Pilarcitos Reservoir. The SFPUC will operate the aeration system as necessary to avoid anoxic conditions and maintain good water quality conditions at the reservoir.

Table 4.1.3: (Peninsula Watersheds - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern		
GROUNDWATER						
Impact 5.5.4-1: Alteration of stream flows along Pilarcitos Creek, which could affect groundwater levels and water quality.	LS					None required.
FISHERIES						
Impact 5.5.5-1: Effects on fishery resources in Crystal Springs Reservoir (Upper and Lower).	PSU					Measure 5.5.5-1, Create New Spawning Habitat Above Crystal Springs Reservoir: The SFPUC will survey the extent and quality of fish spawning habitat lost due to inundation and, if feasible, create new spawning habitat at a higher elevation. The specifics of this mitigation measure will be determined as part of project-level CEQA review.
Impact 5.5.5-2: Effects on fishery resources in San Andreas Reservoir.	LS					None required.
Impact 5.5.5-3: Effects on fishery resources along San Mateo Creek.	LS					None required.
Impact 5.5.5-4: Effects on fishery resources in Pilarcitos Reservoir.	PSM					Measure 5.5.3-2b. Aeration System at Pilarcitos Reservoir – see description above.

Table 4.1.3: (Peninsula Watersheds - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special-Status Species	Other Species of Concern		
FISHERIES (continued)						
Impact 5.5.5-5: Effects on fishery resources along Pilarcitos Creek below Pilarcitos Reservoir.	PSM					Measure 5.5.3-2a. Low-head Pumping Station at Pilarcitos Reservoir – see description above. Measure 5.5.5-5. Establish Flow Criteria, Monitor and Augment Flow: The SFPUC will develop a monitoring and operations plan for Stone Dam to ensure WSIP-related flow reductions downstream of Stone Dam do not impair steelhead passage and spawning during the winter months of normal and wetter hydrologic years.
TERRESTRIAL BIOLOGY						
Impact 5.5.6-1: Impacts on biological resources in Upper and Lower Crystal Springs Reservoirs.		PSM	PSM	PSM	PSM	The SFPUC will implement Measures 5.5.6-1a and 5.5.6-1b to reduce adverse impacts on sensitive habitats, key special-status species, other species of concern, and common habitats and species to a less-than-significant level. In addition, the SFPUC will implement Measure 5.5.6-1c to mitigate adverse impacts to key special-status plant species (i.e., fountain thistle) adapted to serpentine seeps. Measure 5.5.6-1a, Adaptive Management of Freshwater Marsh and Wetlands at Upper and Lower Crystal Springs Reservoirs: The SFPUC will develop an adaptive management plan to minimize adverse effects of the WSIP-induced rise in average water levels, and periodic drawdown of reservoir water levels for maintenance, on San Francisco garter snakes and red-legged frogs.

Table 4.1.3: (Peninsula Watersheds - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts				
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern	Common Habitats and Species	
TERRESTRIAL BIOLOGY (continuation)						
						Measure 5.5.6-1b, Compensation for Impacts on Terrestrial Biological Resources: The SFPUC will protect, restore, and enhance existing wetland and upland habitat and/or create new habitat that compensates for WSIP-induced habitat losses at Crystal Springs Reservoir. Compensatory habitat may be provided as part of the SFPUC's Habitat Reserve Program. Measure 5.5.6-1c, Compensation for Serpentine Seep-Related Special-Status Plants: The SFPUC will protect, restore, and enhance existing habitat and/or create new habitat that compensates for WSIP-induced habitat losses for plant species adapted to serpentine seeps.
Impact 5.5.6-2: Impacts on biological resources in San Andreas Reservoir.		LS	LS	LS	LS	None required.
Impact 5.5.6-3: Impacts on biological resources along San Mateo Creek below Lower Crystal Springs Dam.		LS	LS	LS	LS	None required.

Table 4.1.3: (Peninsula Watersheds - Continued)

Impact	Significance Determination					Mitigation Measures
	All Impacts (except Biological Resources)	Biological Resource Impacts			Common Habitats and Species	
		Sensitive Habitats	Key Special-Status Species	Other Species of Concern		
TERRESTRIAL BIOLOGY (continuation)						
Impact 5.5.6-4: Impacts on biological resources in Pilarcitos Reservoir.		LS	PSM	LS	LS	Measure 5.5.3-2c. Habitat Monitoring and Compensation: The SFPUC will protect, restore, and enhance existing habitat and/or create new habitat that compensates for WSIP-induced habitat losses at Pilarcitos Reservoir. Compensatory habitat may be provided as part of the SFPUC's Habitat Reserve Program.
Impact 5.5.6-5: Impacts on biological resources along Pilarcitos Creek below Pilarcitos Reservoir.		LS	LS	LS	LS	None required.
Impact 5.5.6-6: Impacts along Pilarcitos Creek below Stone Dam.		LS	LS	LS	LS	None required.
Impact 5.5.6-7: Conflicts with the provisions of adopted conservation plans or other approved biological resource plans.		LS				None required.

Table 4.1.3: (Peninsula Watersheds - Continued)

Impact	Significance Determination					Mitigation Measures	
	All Impacts (except Biological Resources)	Biological Resource Impacts					
		Sensitive Habitats	Key Special- Status Species	Other Species of Concern			Common Habitats and Species
RECREATIONAL AND VISUAL RESOURCES							
Impact 5.5.7-1: Effects on recreational facilities and/or activities.	LS					None required.	
Impact 5.5.7-2: Visual effects on scenic resources or the visual character of water bodies.	LS					None required.	
	Not applicable						

 Not applicable

Table 4.1.4: Summary of Water Supply Impacts and Mitigation Measures in the WSIP PEIR – Westside Groundwater Basin

Impact	Significance Determination		Mitigation Measures
	North Westside Groundwater Basin	South Westside Groundwater Basin	
RECREATIONAL AND VISUAL RESOURCES			
Impact 5.6-1: Basin overdraft due to pumping from the Westside Groundwater Basin.	PSM	LS	The SFPUC will implement Measure 5.6.1 to reduce adverse impacts to the North Westside Groundwater Basin to a less-than-significant level. Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield: The SFPUC will continue ongoing groundwater and lake level monitoring programs to determine the safe yield of the North Westside Groundwater Basin in order to avoid overdraft and associated effects including adverse effects on surface water features and seawater intrusion.
Impact 5.6-2: Changes in water levels in Lake Merced and other surface water features, including Pine Lake, due to decreased groundwater levels in the Westside Groundwater Basin.	PSM	N/A	The SFPUC will implement Measures 5.6.1 and 5.6-2 to reduce adverse impacts to the North Westside Groundwater Basin to a less-than-significant level. Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield – see description above. Measure 5.6-2, Implementation of a Lake Level Management Plan: The SFPUC will develop and implement a lake level management plan identifying strategies for altering pumping patterns or lake augmentation to maintain Lake Merced water levels within the desired long-term range.
Impact 5.6-3: Seawater intrusion due to decreased groundwater levels in the Westside Groundwater Basin.	PSM	LS	The SFPUC will implement Measure 5.6.1 to reduce adverse impacts to the North Westside Groundwater Basin to a less-than-significant level. Measure 5.6-1, Groundwater Monitoring to Determine Basin Safe Yield – see description above.

Table 4.1.4: (Westside Groundwater Basin - Continued)

Impact	Significance Determination		Mitigation Measures
	North Westside Groundwater Basin	South Westside Groundwater Basin	
RECREATIONAL AND VISUAL RESOURCES (continued)			
Impact 5.6-4: Land subsidence due to decreased groundwater levels in the Westside Groundwater Basin if the historical low water levels are exceeded.	LS	LS	None required.
Impact 5.6-5: Contamination of drinking water due to groundwater pumping in the Westside Groundwater Basin.	PSM	PSM	The SFPUC will implement Measure 5.6.5 to reduce adverse impacts to the North Westside and South Westside Groundwater Basins to a less-than-significant level. Measure 5.6.5, Drinking Water Source Assessments for Groundwater Wells: The SFPUC will develop and implement a source water protection program for wells constructed under the Local and Regional Groundwater Projects that are considered vulnerable to contamination on the basis of the drinking water source assessment prepared in accordance with Department of Health Services regulations.
Impact 5.6-6: Drinking water contaminants above maximum contaminant levels and adverse effects of adding treated groundwater to the distribution system.	LS	LS	None required.

Table 4.1.5: Summary of Water Supply Impacts and Mitigation Measures in the WSIP PEIR – Cumulative Water Supply

Cumulative Water Supply Impact	Cumulative Impact Significance Determination							Mitigation Measures
	Hydrology	Geomorphology	Surface Water Quality	Groundwater	Fisheries	Terrestrial Biology	Recreation / Visual Quality	
Impact 5.7.2-1: Tuolumne River – Hetch Hetchy Reservoir to Don Pedro Reservoir.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.2-2: Tuolumne River – Don Pedro Reservoir to the San Joaquin River.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.2-3: San Joaquin River, Stanislaus River, and the Delta.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.3-1: Alameda Creek watershed.	N/A	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.4-1: San Mateo Creek watershed.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.4-2: Pilarcitos Creek watershed.	LS	LS	LS	LS	LS	LS	LS	None required.
Impact 5.7.5-1: North Westside Groundwater Basin.	LS							None required.
Impact 5.7.5-2: South Westside Groundwater Basin.	LS							None required.
Note: Significance determinations presented in this table assume implementation of all mitigation measures as they are presented in Chapter 5, Section 5.6, and described in Chapter 6 of the PEIR.								

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4.2 PLANS AND POLICIES

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4.2.1 INTRODUCTION

This section identifies and discusses regional and local land use plans and policies relevant to the proposed Calaveras Dam Replacement Project (CDRP).

Pursuant to *CEQA Guidelines* Section 15125(d), this section first describes land use plans and policies and the manner in which they apply to the CDRP, and then discusses the project's consistency with applicable plans. The focus of this section is the City and County of San Francisco (CCSF) land use plans and policies, which are primarily applicable to projects within the jurisdictional boundaries of San Francisco, although in some cases may apply to projects outside of San Francisco. Although the SFPUC is not legally bound by the planning and building laws of other local jurisdictions for projects on CCSF-owned extraterritorial lands (see Subsection 4.2.2, Extraterritorial Lands), non-CCSF land use plans also are discussed to the extent that they provide general land use planning information for the jurisdiction in which the project is located. This information is relevant to the evaluation of impacts of the project with respect to specific significance criteria under CEQA that require an analysis of the compatibility of a proposed project with certain aspects of local land use plans or policies.

The proposed project would be located entirely on property owned by the CCSF in unincorporated Alameda and Santa Clara Counties. No variances, special authorizations, or changes to the San Francisco Planning Code are proposed as part of this project. Therefore, these issues are not discussed further. As described in Subsection 3.7, Discretionary Approvals and Agencies Involved, in Chapter 3, Project Description, the San Francisco agencies responsible for approving the overall dam replacement project and Environmental Impact Report (EIR) include

the San Francisco Planning Commission, San Francisco Public Utilities Commission (SFPUC), and San Francisco Board of Supervisors (if EIR certification were to be appealed). This section addresses the following plans and policies that pertain to the CCSF, the SFPUC, and other local agencies:

- City and County of San Francisco: *San Francisco General Plan*, *Accountable Planning Initiative*, *San Francisco Sustainability Plan*, San Francisco Municipal Green Building Program.
- SFPUC: *Alameda Watershed Management Plan*, Water Enterprise Environmental Stewardship Policy.
- Other local agencies: Local general plans of Alameda County, Santa Clara County, East Bay Regional Park District (EBRPD), and the cities of Fremont and Milpitas.

The analysis in this section complements analyses in Sections 4.3 through 4.16, which describe resource-specific plans (e.g., air quality management plans are discussed in Section 4.13, Air Quality); and in Subsection 6.1, Growth Inducement (see Chapter 6, Other Topics Required by CEQA), which describes plans and policies related to growth in population and employment.

4.2.2 EXTRATERRITORIAL LANDS

Under the San Francisco City Charter, Section 8B.121, the SFPUC has authority over the management, use, and control of extraterritorial lands, that is, properties outside of the San Francisco city limits that the CCSF owns or leases or over which it holds easements. Section 8B.121 provides:

Notwithstanding Charter Section 4.112, the Public Utilities Commission shall have exclusive charge of the construction, management, supervision, maintenance, extension, expansion, operation, use and control of all water, clean water and energy supplies and utilities of the City as well as the real, personal and financial assets, that are under the Commission's jurisdiction or assigned to the Commission under Section 4.132.

Although the *San Francisco General Plan* and *San Francisco Sustainability Plan* were developed for lands within the jurisdictional boundaries of San Francisco, their underlying goals apply to SFPUC projects on extraterritorial lands. The *Alameda Watershed Management Plan* specifically applies to CCSF-owned extraterritorial lands in Alameda County and Santa Clara County.

California Government Code Section 53090 *et seq.* provides that the SFPUC receives intergovernmental immunity from the planning and building laws of other cities and counties. The SFPUC, however, seeks to work cooperatively with local jurisdictions where CCSF-owned facilities are sited outside of San Francisco to avoid conflicts with local land use plans and building and zoning codes. Also, the SFPUC is required under Government Code Section 65402(b) to inform local governments of its plans to construct projects or acquire or

dispose of its extraterritorial property. The local governments have a 40-day review period to determine project consistency with their general plans. Under this requirement, the cities' or counties' determinations of consistency are advisory to the SFPUC rather than binding.

4.2.3 CITY AND COUNTY OF SAN FRANCISCO PLANS AND POLICIES

The City and County of San Francisco land use plans and policies are primarily applicable to projects within the jurisdictional boundaries of San Francisco, although in some cases they may apply to projects outside of San Francisco. The SFPUC is guided by the San Francisco City Charter along with other city plans and policies. These plans include the *San Francisco General Plan*, which sets forth the comprehensive, long-term land use policy for San Francisco, *San Francisco Sustainability Plan*, which addresses the long-term sustainability¹ of the City, and the San Francisco Municipal Green Building Program, which establishes green building standards for municipal projects. In addition, the SFPUC has adopted various plans and policies that further direct its activities, including the *Alameda Watershed Management Plan* and the Water Enterprise Environmental Stewardship Policy. The project is located within the jurisdictional boundaries of the *Alameda Watershed Management Plan*, which governs SFPUC-owned watershed lands in Alameda and Santa Clara Counties.

4.2.3.1 SAN FRANCISCO GENERAL PLAN

The *San Francisco General Plan* sets forth the comprehensive, long-term land use policy for San Francisco. One of the basic goals of the *General Plan* is "coordination of the growth and development of the city with the growth and development of adjoining cities and counties and of the San Francisco Bay region." The *General Plan* consists of ten issue-oriented plan Elements: Air Quality, Arts, Commerce and Industry, Community Facilities, Community Safety, Environmental Protection, Housing, Recreation and Open Space, Transportation, and Urban Design. It also includes Area Plans that establish objectives and policies for specific neighborhoods in the jurisdictional boundaries of San Francisco; none of these Area Plans is applicable to extraterritorial lands.

The *General Plan* Elements that may be relevant to the CDRP are briefly described below (CCSF 1988). Overall, the policies of the *San Francisco General Plan* were developed for lands within San Francisco and most *General Plan* policies are not directly relevant to the SFPUC or its extraterritorial lands. Consistency of the project with the *San Francisco General Plan* is discussed below in Subsection 4.2.5.1, Consistency with San Francisco Plans and Policies.

¹ Sustainability or sustainable development can be defined as development that meets the needs of the present without compromising the ability of future generations to meet their needs.

Air Quality Element

The Air Quality Element promotes the goal of clean air planning through objectives and policies aimed at adherence to air quality regulations.

Commerce and Industry Element

The Commerce and Industry Element serves as a guide for decisions related to economic growth and change in San Francisco. The three goals of the Element—continued economic vitality, social equity (with respect to employment opportunities), and environmental quality—address general citywide objectives, as well as objectives for each of the major sectors of San Francisco's economy.

Community Safety Element

The Community Safety Element addresses the potential for geologic, structural, and nonstructural hazards to affect CCSF-owned structures and critical infrastructure. The goal of this Element is to protect human life and property from hazards.

Environmental Protection Element

The Environmental Protection Element addresses the impact of urbanization on the natural environment. It promotes improvement of air quality and of bay and ocean shorelines, and the protection of plant and animal life and fresh water sources. It also speaks to the responsibility of San Francisco to provide a permanent, clean water supply to meet present and future needs and to maintain an adequate water distribution system.

Urban Design Element

The Urban Design Element promotes the preservation of landmarks and structures with notable historic, architectural, or aesthetic value.

Recreation and Open Space Element

The Recreation and Open Space Element contains objectives and policies related to maintaining, creating, and enhancing recreational and open space resources. This Element acknowledges the need to protect water quality and therefore restrict recreational uses on the City's watershed property.

4.2.3.2 ACCOUNTABLE PLANNING INITIATIVE

In November 1986, the voters of San Francisco approved Proposition M, the Accountable Planning Initiative, which added Section 101.1 to the City Planning Code to establish eight Priority Policies. The Priority Policies are as follows:

1. Existing neighborhood-serving retail uses shall be preserved and enhanced and future opportunities for resident employment in and ownership of such businesses enhanced.
2. Existing housing and neighborhood character shall be conserved and protected in order to preserve the cultural and economic diversity of our neighborhoods.
3. The City's supply of affordable housing shall be preserved and enhanced.
4. Commuter traffic shall not impede Muni transit service or overburden our streets or neighborhood parking.
5. A diverse economic base shall be maintained by protecting our industrial and service sectors from displacement due to commercial office development, and future opportunities for resident employment and ownership in these sectors shall be enhanced.
6. The City shall achieve the greatest possible preparedness to protect against injury and loss of life in an earthquake.
7. Landmarks and historic buildings shall be preserved.
8. Parks and open space and their access to sunlight and vistas shall be protected from development.

In accordance with the Accountable Planning Initiative, prior to issuing a permit for any project, or adopting legislation that requires an initial study under the California Environmental Quality Act (CEQA), or adopting any zoning ordinance or development agreement, and before taking any action that requires a finding of consistency with the *General Plan*, the City is required to find that the project is consistent with the Priority Policies established by Proposition M.

4.2.3.3 SAN FRANCISCO SUSTAINABILITY PLAN

The San Francisco Board of Supervisors endorsed the San Francisco Sustainability Plan in 1997, but has not committed the City to perform the actions addressed in the plan. The plan serves as a blueprint for sustainability, with many of its individual proposals requiring further development and public comment. The underlying goals of the plan are to maintain the physical resources and systems that support life in San Francisco and to create a social structure that will allow such maintenance. The plan is divided into 15 topic areas, 10 that address specific environmental issues (air quality; biodiversity; energy, climate change, and ozone depletion; food and agriculture; hazardous materials; human health; parks, open spaces and streetscapes; solid waste; transportation; and water and wastewater), and 5 that are broader in scope and cover many issues (economy and economic development; environmental justice; municipal expenditures; public information and education; and risk management). Under the topic area of water, there are goals addressing water reuse, water quality, and adequacy of water supply, groundwater supply, and

infrastructure. Each topic area in the plan has a set of indicators that are to be used over time to determine whether San Francisco is moving in a sustainable direction in that particular area (CCSF 1997).

4.2.3.4 SAN FRANCISCO MUNICIPAL GREEN BUILDING PROGRAM

San Francisco's Green Building Program was founded in 1999 when the CCSF adopted the Resource Efficient Building Ordinance, which established green building standards for municipal buildings to increase energy efficiency, conserve CCSF finances, reduce the environmental impacts of demolition, construction, and operation of buildings, and create safe workplaces for CCSF employees and visitors. The ordinance created the interdepartmental Resource Efficient Building (REB) Task Force and charged the San Francisco Department of the Environment with implementing the ordinance in partnership with the Department of Public Works and other REB Task Force departments. In 2004, amendments to Chapter 7 of the Environment Code set Leadership in Energy and Environmental Design (LEED) Silver Certification by the U.S. Building Council as the minimum environmental performance requirement for all municipal projects over 5,000 square feet. The REB Task Force assists City departments in compliance with the LEED Silver Certification requirement and helps to determine which projects are applicable for LEED ratings. For all municipal construction projects, including those projects that do not involve buildings and are not required to obtain LEED Silver Certification, the REB Task Force provides recommended best practices and sample specifications for building materials such as recycled content of steel and concrete (SF Dept of the Environment 2004-2007).

4.2.3.5 SFPUC PLANS AND POLICIES

The SFPUC adopted the *Alameda Watershed Management Plan* in 2001 and the Water Enterprise Environmental Stewardship Policy in 2006.

Alameda Watershed Management Plan

The SFPUC *Alameda Watershed Management Plan* (San Francisco Planning Department 2001, SFPUC 2001) applies to CCSF-owned lands in the Alameda Creek watershed. This plan provides a policy framework for the SFPUC to use in making decisions about activities that are appropriate on watershed lands. This includes all lands within the CDRP study area evaluated in this EIR. The plan provides goals, policies, and management actions that address resource-based facilities operation and watershed management activities, and reflect the unique natural resources and their qualities in the watershed. The *Alameda Watershed Management Plan* is also intended to be used by the SFPUC as a program of watershed management implementation guidelines. Watershed lands are managed by the SFPUC Natural Resources Division, Watershed Resource Management Section. However, the reservoir is operated and managed by the Water Supply and Treatment Division.

As part of implementation of the *Alameda Watershed Management Plan*, the SFPUC reviews all plans, projects, and activities that occur within the SFPUC Alameda Watershed for conformity with the management plans and for compliance with environmental codes and regulations. To accomplish this, the SFPUC has established a project review team with members from various SFPUC departments as well as the City Attorney's office. Appropriate SFPUC personnel review proposals for new facilities, structures, roads, trails, projects, and leases or for improvements to existing facilities. Projects subject to this review include those that involve construction, digging or earthmoving, clearing, installation, use of hazardous materials, or other disturbance to watershed resources. In addition, projects that involve the issuance of new or revised leases and permits are subject to this review procedure.

For the *Alameda Watershed Management Plan*, the SFPUC considers water quality protection as the first and foremost goal. The goals and policies are organized around this primary goal of maintaining and improving source water quality and around secondary goals pertaining to maximizing local water supply, natural resource protection, watershed protection, land use compatibility, fiscal management, and public awareness. Specifically, the primary and secondary goals of the *Alameda Watershed Management Plan* are as follows:

- Primary Goal: Maintain and improve source water quality to protect public health and safety.
- Secondary Goals:
 - Maximize water supply.
 - Preserve and enhance the ecological and cultural resources of the watershed.
 - Protect the watersheds, adjacent urban areas, and the public from fire and other safety hazards.
 - Continue existing compatible uses and provide opportunities for potential compatible uses on watershed lands, including educational, recreational, and scientific uses.
 - Provide a fiscal framework that balances financial resources, revenue-generating activities, and overall benefits and an administrative framework that allows implementation of the watershed management plans.
 - Enhance public awareness of water quality, water supply, conservation, and watershed protection issues.

Water Enterprise Environmental Stewardship Policy

Adopted in June 2006, the purpose of the Water Enterprise Environmental Stewardship Policy is to establish long-term management direction for CCSF-owned lands and natural resources affected by operation of the SFPUC water system within the Tuolumne River, Alameda Creek, and Peninsula watersheds (SFPUC 2006). It also addresses rights-of-way and properties in urban surroundings under SFPUC management. The policy includes the following:

Water Management

- The SFPUC will proactively manage the watersheds under its responsibility in a manner that maintains the integrity of the natural resources, restores habitats for native species, and enhances ecosystem function.
- To the maximum extent practicable, the SFPUC will ensure that all operations of the SFPUC water system (including water diversion, storage, and transport), construction and maintenance of infrastructure, land management policies and practices, purchase and sale of watershed lands, and lease agreements for watershed lands protect and restore native species and the ecosystems that support them.
- The SFPUC will operate the SFPUC water system in a manner that protects and restores native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands. Releases from SFPUC reservoirs will (consistent with the SFPUC mission described above, existing agreements, and applicable state and federal laws), mimic the variation of the seasonal hydrology (e.g., magnitude, timing, duration, and frequency) of their corresponding watersheds in order to sustain the aquatic and riparian ecosystems upon which these native fish and wildlife species depend.

Other SFPUC Lands

- Rights-of-way and properties in urban surroundings under SFPUC management will be managed in a manner that protects and restores habitat value where available, and encourages community participation in decisions that significantly interrupt or alter current land use on these parcels.

The Water Enterprise Environmental Stewardship Policy calls for public involvement that includes input and collaboration with other local, state and government agencies, nongovernmental organizations and members of the public, as well as encouraging development of recreational uses that are compatible with protection and restoration of natural resource, water quality, and water supply reliability goals. Key implementation strategies relevant to the CDRP include updating the *Alameda Watershed Management Plan* (described above); developing the Habitat Conservation Plan for the Alameda Creek watershed (described in Section 4.4, Vegetation and Wildlife); and developing and implementing the Watershed and Environmental Improvement Program (WEIP), which will include the Alameda Creek watershed.

The WEIP seeks to identify, prioritize, protect, and restore lands within the hydrologic boundaries, which contribute to source waters in the Alameda Creek, Peninsula, and Tuolumne River watersheds. The WEIP will ensure delivery of high quality water to Bay Area communities and the preservation and restoration of significant ecological resources throughout SFPUC watershed lands. Projects in the WEIP will be funded with revenue bonds to the extent permitted by law and by system revenues. Initial implementation of the WEIP began in fiscal year 2006-2007, and is expected to continue in the current fiscal year.

The SFPUC is preparing a Habitat Reserve Program (HRP) to provide a coordinated and consolidated approach to compensate for habitat impacts that would result from proposed implementation of the SFPUC WSIP in the San Joaquin Valley, Sunol Valley, Bay Division, and Peninsula regions of the SFPUC water system (San Francisco Planning Department 2007). The HRP is funded through the SFPUC Water System Improvement Program (WSIP) bond financing. The HRP includes a variety of habitat preservation, restoration, and enhancement actions, as well as the possibility of creating habitats where appropriate. HRP projects in the Sunol Valley region would be located primarily on SFPUC-owned land in Alameda and Santa Clara Counties. Implementation of habitat improvements under the HRP would be coordinated with and supplemental to other SFPUC environmental improvement projects, including the WEIP and the Alameda Creek watershed Habitat Conservation Plan now in preparation.

4.2.4 OTHER JURISDICTIONS' LAND USE PLANS AND POLICIES

The proposed project would be located on extraterritorial lands owned by the CCSF in unincorporated Alameda and Santa Clara Counties. As discussed above, the proposed project would not be legally bound to Alameda or Santa Clara County's planning and building policies. However, the Counties' land use plans and policies are discussed in this section to the extent that they are relevant to the specific significance criteria that require an analysis of the compatibility of a proposed project with certain aspects of local land use plans and policies. These particular significance criteria are listed below, along with the section of this document in which the reader can find the impact evaluation:

- Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., conflict with policies promoting bus turnouts, bicycle racks, etc.), or would cause a substantial increase in transit demand that cannot be accommodated by existing or proposed transit capacity or alternative travel modes. (Not Applicable)
- Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. (Analyzed in Section 4.14, Noise and Vibration)
- For a project located within an area covered by an airport land use plan (or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport), expose people residing or working in the project area to excessive noise levels. (Not Applicable)
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. (Analyzed in Section 4.4, Vegetation and Wildlife, and Section 4.5, Fisheries and Aquatic Habitat)
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan. (Not Applicable)²

² The SFPUC began the Habitat Conservation Planning process for the Alameda Watershed in 2003. After several years of ongoing public workshops to formulate the plan, the draft Habitat Conservation Plan for the Alameda Creek watershed is currently undergoing environmental review. Publication of the Draft EIS/EIR is anticipated by early 2010 and certification of the Final EIS/EIR is anticipated by late 2010. Because the Alameda Watershed HCP has

- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan. (Analyzed in Section 4.16, Mineral and Energy Resources)
- Conflict with existing zoning for agricultural use or a Williamson Act contract.³ (Not Applicable)

The proposed project is located in unincorporated Alameda County and Santa Clara County, near the cities of Fremont and Milpitas located, respectively, in these two counties. The project site is in the southern portion of the Alameda Creek watershed, located entirely on land owned by the CCSF through the SFPUC.⁴ The EBRPD also owns or leases from the SFPUC over 13,500 acres of regional parkland north of the project site. Because the project site is situated among vast acres of watershed lands and regional open space that are surrounded by urban development, Alameda and Santa Clara Counties have adopted a number of policies in their respective planning documents aimed at the protection, management, and public use of these natural resources, while limiting encroachment from surrounding development. The nearby cities of Fremont and Milpitas also have adopted general plan policies relevant to protection of regional open space from development beyond their urban boundaries west of the Alameda Creek watershed. Additionally, all of these planning documents include policies to protect SFPUC watershed lands and to encourage recreational opportunities on these lands as appropriate.

The following factors affect the application of these communities' general plans to the proposed project:

- Local Agency Project Approval: Local agency approval of encroachment permits would be required from Alameda and Santa Clara Counties, to the extent the project requires construction on or occupation of these entities' property such as streets and highways. Permits would also be required from these counties for temporary closure of Calaveras Road, as well as from Alameda County for blasting (see Subsection 3.7, Discretionary Approvals and Agencies Involved, in Chapter 3, Project Description).
- Building and Zoning Ordinances: Building and zoning ordinances represent the most specific expressions of general plan goals, objectives, and policies. State law and judicial interpretations of state law (California Government Code Section 53090 *et seq.*) mutually exempt cities and counties from complying with each other's building and zoning ordinances. The SFPUC, which is part of the CCSF, is therefore exempt from complying with the building and zoning ordinances of other cities and counties. In addition, Water Code Section 6026 provides that no city or county has the authority to regulate, supervise, or provide for the regulation or supervision of any dam or reservoir in California that is under the California Department of Water Resources, Division of Safety

not yet been adopted by the SFPUC, this significance criteria would not be applicable to the CDRP.

³ Under a Williamson Act (Land Conservation Act of 1965) contract, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least 10 years. In return, the land is taxed at a rate based on the agricultural production of the land, rather than its real estate market value.

⁴ Approximately one-third (or 36,000 acres) of the Alameda Creek watershed is owned by the SFPUC, split between Alameda County (23,000 acres) and Santa Clara County (13,000 acres).

of Dams (DSOD) jurisdiction; the State has exclusive jurisdiction over construction and operation of jurisdictional dams like Calaveras Dam.

- **Local Government Notification and Consistency Determination Requirements:** California Government Code Section 65402(b) requires that the SFPUC inform cities and counties of its plans to construct projects or acquire or dispose of extraterritorial property. The local governments have 40 days to determine project consistency with their general plans; these consistency determinations are advisory to the SFPUC rather than binding. The SFPUC would notify local governments of the CDRP and associated facilities that would be constructed, upgraded, or replaced within their respective jurisdictions as part of the CEQA process. Prior to project implementation, affected local governments, including Alameda and Santa Clara Counties, would be notified pursuant to California Government Code Section 65402(b).

Notwithstanding the above, where CCSF-owned facilities are sited outside of San Francisco, the SFPUC seeks to work cooperatively with local jurisdictions to avoid conflicts with local land use plans and building and zoning codes. The intent of the general plans prepared by these communities is to preserve and improve the quality of life for its citizens and to consider growth in a manner that appropriately reflects the community's values; an adequate, reliable water supply is a chief public service needed to accomplish these goals.

A key issue for local jurisdictions that receive SFPUC water, including generally cities and special purpose districts in Alameda and Santa Clara Counties, and the cities of Fremont (through the Alameda County Water District) and Milpitas, is whether the CDRP would support community goals regarding water service for existing and future land uses.

A second issue of importance to local jurisdictions is whether implementation of the project would be consistent with community goals regarding resource protection. A summary of general plan policies and goals that address the protection of environmental resources or the mitigation of environmental impacts is presented below. All of the issues identified in the general plan discussions are addressed in this EIR in one form or another; some specific policies are used as criteria to determine the significance of physical effects on the environment.

4.2.4.1 ALAMEDA COUNTY GENERAL PLAN

The Alameda County line runs east to west through the northern portion of the Calaveras Dam and Reservoir (see, e.g., Figure 3.2, Calaveras Dam Vicinity, in Chapter 3, Project Description). The proposed replacement dam and the majority of project construction would be on the northern portion of the project site on SFPUC lands located in eastern Alameda County.

Land use planning for eastern Alameda County is governed by the *East County Area Plan* (ECAP) of the *Alameda County General Plan*. The ECAP contains four policy areas: Land Use; Transportation; Public Services and Facilities; and Environmental Health and Safety (Alameda County 1994). The project area is within the County's unincorporated rural area, outside of the

urban growth limits. The Alameda Creek watershed, which includes the project site, is designated as “Water Management” land by the ECAP. The “Water Management” designation includes a protected open space requirement. Generally, the land use designations and pertinent policies of the ECAP in this part of the County discourage intensive development; discourage encroachment of urban uses and access roads; encourage preservation of cultural resources; and encourage protection of open space and natural resources, especially on SFPUC watershed lands.

The Land Use Element of the ECAP contains specific watershed policies that encourage land use activities that would not adversely affect the watershed protection objectives and purposes of the SFPUC, and explore development of recreation on SFPUC land and surrounding public open space. These ECAP policies also support interjurisdictional coordination among various agencies to protect open space and natural resources and to support expansion of regional park facilities and trail systems. The Environmental Health and Safety Element of the ECAP calls for noise studies to minimize exposure to high noise levels adjacent to sensitive uses as well as air quality controls and mitigation to reduce potential impacts of new development. With respect to earthquakes, the Environmental Health and Safety Element requires that critical facilities be designed and constructed to remain standing and functional following an earthquake. The ECAP specifies that all new development, including water storage facilities, shall be reviewed prior to approval to incorporate measures that would minimize erosion and disruption to natural slope stability, and to reduce potential risk to geologic, flood, and fire hazards.

4.2.4.2 SANTA CLARA COUNTY GENERAL PLAN

The Santa Clara County line runs east to west through the Calaveras Reservoir. A portion of the project site where work related to the project would be performed (Borrow Area E, Disposal Site 5, access roads, and biological mitigation areas) is located on SFPUC lands in Santa Clara County. Most of the Calaveras Creek and Alameda Creek watersheds that supply Calaveras Reservoir are also in Santa Clara County. The *Santa Clara County General Plan* sets forth the comprehensive, long-term land use policy for the County (County of Santa Clara 1994). The *General Plan* contains two booklets. Book A focuses on countywide issues and policies, such as growth and development and economic well-being. Book B focuses on rural and unincorporated area issues and policies, including rural issues of land use, growth, and development. The rural elements in Book B address the Alameda Creek watershed. Policies contained in the *General Plan*’s Resource Conservation and Health and Safety Elements focus on the Alameda Creek watershed area surrounding the Calaveras Dam and Reservoir. The Health and Safety Element specifies that critical infrastructure vital to public health, such as water supply facilities, shall not be located in areas subject to significant impacts from geologic or seismic hazards unless there is no feasible alternative site, and shall be designed to mitigate any seismic hazards.

The *Santa Clara County General Plan* lists the Calaveras Creek watershed as “Other Public Open Lands” (Open Space) within a Resource Conservation Area. The Alameda Creek watershed is

outside the Urban Service Area that separates urban from rural land designations. "Other Public Open Lands" refers to lands in open space that are owned by various public agencies for purposes other than public parks and general recreational use. "Resource Conservation Areas" refers to a general category of land uses that consists of the following specific land use designations or classifications: baylands, agriculture, hillsides, ranchlands, open space reserve, regional parks, and other public open space lands.

The general intent of each Resource Conservation Area designation is to encourage land uses and densities appropriate to the rural unincorporated areas that also:

- Help preserve rural character;
- Conserve natural, scenic (including scenic highways), and cultural resources;
- Protect public health and safety from natural and man-made hazards;
- Preserve agriculture and prime agricultural soils;
- Protect watersheds and water quality, including development of comprehensive watershed management plans;
- Enhance air quality; and
- Minimize the demand for and cost of public services and facilities.

4.2.4.3 EAST BAY REGIONAL PARK DISTRICT MASTER PLAN

The EBRPD, which provides and manages the regional park system for Alameda and Contra Costa Counties, has established policies in the *East Bay Regional Park District Master Plan (EBRPD Master Plan)* that pertain to the protection of natural and cultural resources within its established parklands (EBRPD 1997). The proposed project is not located within any parkland that is owned, leased, or operated by the EBRPD. There are two designated EBRPD trails in the project vicinity; one is existing and the other proposed. The nearest existing designated trail is the Ohlone Wilderness Regional Trail (Ohlone Trail), located about 1 mile north of the project site, which extends east-west across Calaveras Road and connects to the Bay Area Ridge Trail to the west. A proposed trail segment (Sunol to Pleasanton Trail) is located about 1.5 miles northwest of the project site. This proposed trail is west of and parallel to Calaveras Road and would connect the Pleasanton Ridge Regional Park with an existing trail in the Sunol Wilderness Regional Preserve (Sunol Wilderness) (EBRPD 2007). These trails are further discussed in Section 4.3, Land Use, Agricultural Resources, and Recreation.

The *EBRPD Master Plan* is organized by the following elements: Resource Management, Public Access and Services, and Planning and Acquisition. Because the project site is not located within EBRPD jurisdiction, related policies pertain mostly to regional and multi-agency coordination and resource management of wildlife and water resources, including riparian and other wetland environments, on EBRPD property and surrounding areas. Other policies relate to access to

nearby trails, the closest of which are in the vicinity of Calaveras Road northwest of the project site.

4.2.4.4 CITY OF MILPITAS GENERAL PLAN

The Calaveras Dam and Reservoir is within three-fourths of a mile of the City of Milpitas Planning Area. The general project area is adjacent to the Hillside subarea which comprises the eastern half of the City's Planning Area. The Hillside Area encompasses almost all of the City's undeveloped land, and is characterized by gentle to steep slopes, grassy terrain, wildlife, and geologically unstable areas. To ensure safety and to preserve its natural character, the *Milpitas General Plan* calls for all development in the Hillside Area to be very low density (1 unit per 10 gross acres) and rural residential in nature. Related policies of the *Milpitas General Plan* are included under the topics of Growth and Expansion and Land Use in the *Milpitas General Plan* (City of Milpitas 1997). Collectively, these policies discourage urban development and growth patterns that could encroach onto SFPUC watershed lands to the east.

4.2.4.5 CITY OF FREMONT GENERAL PLAN

Portions of the general project area located in Alameda County are within the City of Fremont's Hill Planning Area. The eastern hills of Fremont form a distinctive open space and visual backdrop to the city. The voters of Fremont consider the eastern hills to be important to the character of the city and adopted initiatives in 1981 and 2002 to provide special protection for them. This Hill Planning Area includes the eastern boundary of the Fremont city limits, and the area beyond the city boundary that extends to the eastern edge of the SFPUC Alameda Watershed. The Hill Area is generally defined as the hill area east of Mission Boulevard, south to the Alameda County-Santa Clara County boundary to the south, north to the Fremont-Union City boundary, and east along Alameda Creek and Calaveras Creek (including the northern portion of the Calaveras Dam and Reservoir facilities).

The *Fremont General Plan* includes goals and policies that address the Hillside Planning Area, most of which focus on residential development standards such as density and lot sizes (City of Fremont 1991). The project area is designated as Institutional Open Space, which is publicly held land permanently committed to open space uses (including parks, agriculture, recreation, preservation of biological resource values, and natural open space). Related goals and policies of the *Fremont General Plan* that address the proposed project Hillside Planning Area are included in the Land Use Element of the *General Plan* under Open Space. These policies focus on the protection of the open space character and natural resources of the eastern hill area, including preservation of the natural terrain. Open space policies also call for conducting early assessment of environmental constraints for new development that specifically addresses geology (e.g., seismicity, soils, and slope); biology (e.g., wetlands and riparian zones); mineral resources; and visual sensitivity.

4.2.5 PLAN CONSISTENCY EVALUATION

The evaluation of plan consistency is based on the applicability of relevant land use plans and policies to the siting, construction, and operation of the CDRP. Because the policy language found in a land use plan is susceptible to varying interpretations, it is often difficult to determine whether a proposed project is consistent or inconsistent with such policies. Because land use plans often contain numerous policies emphasizing differing legislative goals, the proposed project may be consistent with a general plan, taken as a whole, even though it may appear to be inconsistent with specific policies within the plan. The board or commission that enacted the plan or policy generally determines the meaning of such policies; these interpretations prevail if they are “reasonable,” even though other reasonable interpretations are also possible. In light of these considerations, the consistency evaluation in this EIR represents the best attempt to advise the decision-makers as to whether the proposed project is consistent with applicable land use plans and policies.

4.2.5.1 CONSISTENCY WITH SAN FRANCISCO PLANS AND POLICIES

San Francisco General Plan

The *San Francisco General Plan (General Plan)* provides general policies and objectives to guide land use decisions. Any conflict between the proposed project and policies that relate to physical environmental issues are discussed in Chapters 4 and 6. The compatibility of the proposed project with *General Plan* policies that do not relate to physical environmental issues will be considered by decision-makers as part of their decision whether to approve or disapprove the proposed project. Any potential conflicts identified as part of the process would not alter the physical environmental effects of the proposed project.

San Francisco Accounting Planning Initiative Priority Policies

Of the eight Priority Policies, only Priority Policies 6 and 7 would be relevant to the project; the remaining six policies would not be relevant because the proposed project would be constructed outside of San Francisco; be located away from San Francisco neighborhoods; have no effect on or create the need for affordable housing; not result in any commuter automobiles; not result in commercial office development; and have no long-term effect on open space.

The proposed project would implement Priority Policy 6 by replacing the existing seismically unsafe dam with one that would meet current seismic safety requirements, thereby protecting against injury and loss of life in an earthquake from a dam failure.

Potential historic resources on the project site have been surveyed and evaluated for this EIR. The survey concluded that there are no significant historic architectural resources present on the project site (see Section 4.10, Cultural Resources, for further discussion). Therefore, the

demolition of structures as part of the CDRP would be consistent with Priority Policy 7, to preserve historic landmarks and historic buildings.

San Francisco Sustainability Plan

The *San Francisco Sustainability Plan* was developed for the purpose of addressing San Francisco's long-term environmental sustainability. The proposed project would be consistent with the goals of the *Sustainability Plan*, since it would improve the seismic reliability of an important water storage and supply resource that supports life in San Francisco. The project is consistent with goals pertaining to ensuring an adequate water supply under normal and drought conditions and upgrading seismically vulnerable infrastructure.

San Francisco Municipal Green Building Program

The San Francisco Municipal Green Building Program was developed for the purpose of improving the environmental performance of municipal buildings. The proposed project would be consistent with the San Francisco Municipal Green Building Program, since all applicable project improvements would be designed, constructed, and operated in accordance with the City's Green Building requirements. The SFPUC will attempt to meet or exceed LEED Silver certification as required by the City's Green Building Ordinance.

4.2.5.2 CONSISTENCY WITH SFPUC PLANS AND POLICIES

Alameda Watershed Management Plan

The *Alameda Watershed Management Plan* is designed to improve the SFPUC's ability to protect its overall watershed, as well as the specific resources that make up the watershed. The proposed project directly addresses the primary goal of the *Alameda Watershed Management Plan* to maintain and improve water quality to protect public health and safety, and the secondary goal, to maximize local water supply. The SFPUC Natural Resources Division would review the proposed CDRP for conformity with the *Alameda Watershed Management Plan*, as well as for compliance with environmental codes and regulations. As part of project implementation, it is assumed that the project would be carried out in conformance with the appropriate goals, policies, and implementation actions of the *Alameda Watershed Management Plan* as determined by the SFPUC, including those pertaining to water supply protection, and secondary goals of maximizing local water supply, natural resource protection, watershed protection, and land use compatibility.

While the project could have significant impacts during construction and operation on sensitive species and habitats, water quality, visual resources, hazards, cultural resources, transportation, air quality, noise, and geology, the proposed project would avoid certain construction impacts through implementation of SFPUC Greenhouse Gas Reduction Actions (see Subsection 3.5.4 in

Chapter 3, Project Description), and mitigation measures identified in Chapter 5 for sensitive species and habitats, water quality, geology, hazards, cultural resources, transportation, air quality, and noise. Implementation of mitigation measures and compliance with permitting requirements related to the project would be integrated with implementation of ongoing environmental protection and enhancement efforts of the SFPUC, such as the Water Enterprise Environmental Stewardship Policy. By restoring the pre-DSOD restricted capacity of the reservoir, and building a replacement facility that meets current seismic standards, the project would protect and maximize the largest source of local water supply in the SFPUC system. The project would, taken as a whole, be consistent with the *Alameda Watershed Management Plan*.

Water Enterprise Environmental Stewardship Policy

The proposed project could affect the integrity of natural resources, habitats for native species, and ecosystem functions in the Alameda Creek watershed. Significant impacts on natural resources, habitats, or ecosystems could be mitigated through the measures identified in Chapter 5 of this Draft EIR. The project's compliance with the 1997 MOU with California Department of Fish and Game (CDFG) directly addresses the Stewardship Policy to protect and restore native fish and wildlife downstream of the Calaveras Dam. Additionally, the Stewardship Policy implementation strategy specifically requires the integration of the policy into individual infrastructure projects such as the proposed CDRP. With the implementation of these measures, the proposed project would not conflict with the underlying goals of the Water Enterprise Environmental Stewardship Policy.

Consistency of the Project with Local Land Use Plans and Policies

The application of local general plans to the proposed project is discussed under Subsection 4.2.4, Other Jurisdictions' Land Use Plans and Policies. Determinations of project consistency with general plans would be made by the pertinent land use jurisdictions following preparation of this Draft EIR, and notification by the SFPUC pursuant to state law.

For customers who receive all or part of their water from SFPUC in Alameda and Santa Clara Counties, the project would be consistent with goals to maintain and improve the quality of life of the local population by increasing the reliability of the water supply now and into the future. The objectives of the project include reducing system vulnerability to earthquakes; increasing delivery reliability including after a major earthquake; meeting water supply needs; and maintaining high-quality water. The CDRP would be constructed to meet current seismic requirements, thereby addressing local general plan policies to mitigate seismic hazards for critical facilities used for local water supply and storage. (Section 6.1, Growth Inducement, in Chapter 6, Other Topics Required by CEQA, addresses this issue in more detail by comparing the population and employment projections of jurisdictions in Alameda and Santa Clara Counties that rely on SFPUC water with SFPUC projections for water demand.)

Regarding the project's consistency with community goals related to resource protection, through preparation of this EIR and attendant scoping and public outreach efforts, the CCSF has systematically identified the significant environmental impacts associated with implementation of the CDRP, as well as feasible measures and alternatives to avoid or substantially lessen such effects. The significance criteria used in this Draft EIR dovetail with the intent of general plan goals and policies related to protecting the environment.

As detailed throughout the rest of Chapter 4, the proposed project could have significant environmental impacts, including construction and/or operational effects on sensitive species and habitats, water quality, visual resources, hazards, cultural resources, transportation, noise, air quality, and geology. The proposed project would avoid certain construction-related impacts through implementation of SFPUC Greenhouse Gas Reduction Actions (see Subsection 3.5.4 in Chapter 3, Project Description) and mitigation measures identified in Chapter 5 for sensitive species and habitats, water quality, geology, hazards, cultural resources, transportation, air quality, and noise. Implementation of mitigation measures and compliance with permitting requirements related to the project would be integrated with implementation of ongoing environmental protection and enhancement efforts of the SFPUC, such as the Water Enterprise Environmental Stewardship Policy. Although some impacts would remain, with implementation of these measures, on the whole, the proposed project would mitigate impacts to the extent feasible and be consistent with environmental protection policies.

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4.3 LAND USE, AGRICULTURAL RESOURCES, AND RECREATION

Section 4.3 Contents	
4.3.1 Setting	4.3.2 Impacts
4.3.1.1 Regional Setting	4.3.2.1 Approach to Analysis
4.3.1.2 Project Vicinity	4.3.2.2 Summary of Impacts
4.3.1.3 Existing Land Uses	4.3.2.3 Land Use
4.3.1.4 Existing Agricultural Land Uses	4.3.2.4 Agricultural Resources
4.3.1.5 Existing Recreational Land Uses	4.3.2.5 Recreation
4.3.1.6 Regulatory Framework	

This section describes existing land uses in the vicinity of the proposed project, reviews the land use regulatory framework for the proposed project area, and evaluates the compatibility of the replacement dam with the existing land uses in the surrounding area. It also describes the agricultural resources on the watershed lands in the vicinity of the project site and the recreational uses of these lands. The section concludes with a discussion of the project's potential impacts on these land uses.

4.3.1 SETTING

4.3.1.1 REGIONAL SETTING

Calaveras Dam and Reservoir are owned and operated by the San Francisco Public Utilities Commission (SFPUC). The dam and reservoir are located in the Calaveras Valley of the Mount Diablo Range approximately 8 miles south of the unincorporated town of Sunol and 7.5 miles east of the City of Fremont. The Diablo Range separates the Bay Area from the interior San Joaquin Valley. Most of the mountain range is remote, with few roads, utilities, or other urban facilities and services. Typical land uses include private ranch lands, public open space, recreational facilities, and rural commercial and residential development.

4.3.1.2 PROJECT VICINITY

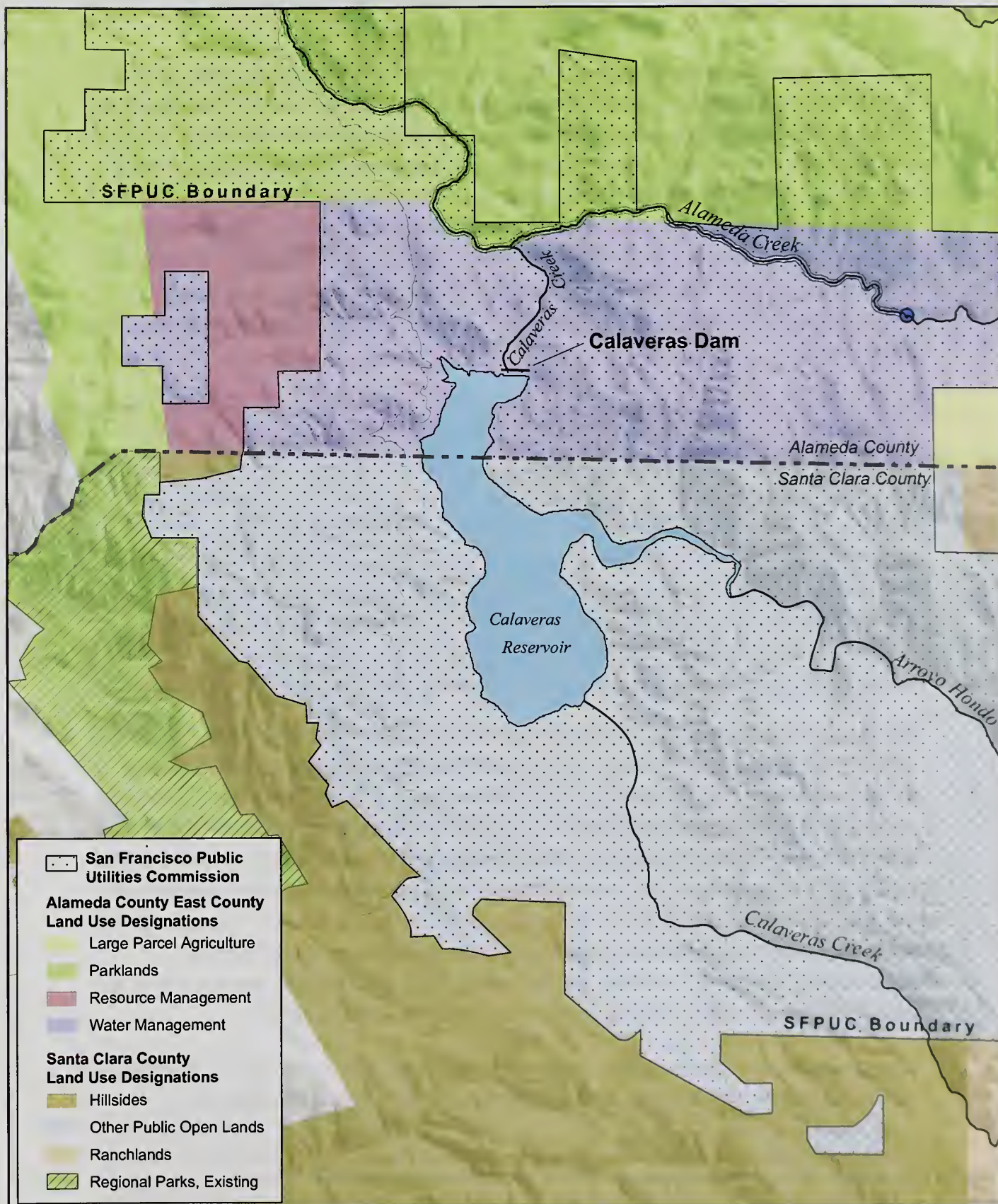
The SFPUC owns 56 square miles (36,000 acres) of the 201-square-mile (128,640-acre) southern Alameda Creek watershed. The SFPUC Alameda Watershed lands include 30,000 acres of primary watershed lands and 6,000 acres of secondary watershed lands. Secondary watershed lands are primarily located in the northern portion of the SFPUC-owned watershed in the Sunol Valley. The proposed project is located in the SFPUC-owned primary watershed lands, the most sensitive lands in terms of water quality protection.

The SFPUC Alameda Creek watershed is split between Alameda County (23,000 acres) and Santa Clara County (13,000 acres). These SFPUC-owned watershed lands act as a buffer between the surrounding urban areas and the many square miles of parks, public open space, and private land holdings to the north, east, and south. Calaveras Dam and Reservoir and the Calaveras Creek and Upper Alameda Creek sub-watersheds are located in both counties. The Arroyo Hondo sub-watershed is located exclusively in Santa Clara County. (See Figure 4.6.2: Sub-Watersheds and Major Hydrologic Features of the Project Watershed, in Section 4.6, Hydrology.) Portions of each sub-watershed are owned and managed by the SFPUC. Calaveras Dam forms Calaveras Reservoir from the captured waters of the 10,693-acre Calaveras Creek sub-watershed and the 51,969-acre Arroyo Hondo sub-watershed. In addition, water from the 21,679-acre Upper Alameda Creek sub-watershed is diverted to the reservoir at the Alameda Creek Diversion Dam by means of the Alameda Creek Diversion Tunnel.

The Interstate 680 freeway (I-680) and State Route 84 meet in the northern portion of the watershed. Calaveras Road, recognized by both Alameda and Santa Clara Counties for its scenic values, extends in a north-south direction from I-680 along the east side of the Sunol Valley. Calaveras Road is used by commuters, residents of the area, and visitors to East Bay Regional Park District (EBRPD) parks. It is also a popular route for cyclists. Between I-680 and Geary Road (north of the dam), Calaveras Road is a two-lane roadway (one lane in each direction). Between Geary Road and Felter Road (west and south of the dam), Calaveras Road is a one-lane, winding mountain roadway used by motorists and by cyclists. Between Felter Road and Evans Road (south of the dam), Calaveras Road is a two-lane roadway (one lane in each direction). To the west of Evans Road, Calaveras Road extends into Milpitas as East Calaveras Boulevard, and connects with Highway 237 and I-680. (See Section 4.11, Visual Resources, and Section 4.12, Transportation and Circulation, respectively, for a discussion of the proposed project's effects on visual resources and the local transportation network.)

4.3.1.3 EXISTING LAND USES

Lands surrounding the SFPUC Alameda Watershed are located in unincorporated portions of Alameda County and Santa Clara County and, for the most part, are comprised of agricultural lands and open space, with some low-density, large-lot rural residential areas. (See Figure 4.3.1: Land Use Designations in the Project Vicinity.) Public open space and private landholdings are used mostly for recreation, natural resource management, or grazing, with some private lands used for utility easements to Pacific Gas and Electric Company (PG&E) for overhead electrical transmission lines. Low-density, large-lot rural residential areas are located south and west of Calaveras Reservoir in Santa Clara County along Felter Road and north of Calaveras Dam in Alameda County along Welch Creek Road. The town of Sunol in Alameda County is the closest developed community to the proposed project site, located about 8 miles north, and includes both



SOURCE: EDAW&Turnstone JV, Alameda County & Santa Clara County

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.3.1: LAND USE DESIGNATIONS IN THE PROJECT VICINITY

residential and commercial development. There is a private in-holding parcel, surrounded by SFPUC land and developed with one home, located about 0.6 miles west of Calaveras Road and 2.4 miles from Borrow Area B/Dam Vicinity. Access to the home is from the Ohlone Wilderness Regional Trail, which intersects with Calaveras Road south of the Calaveras and Geary Road intersection. The property owner is permitted to use a vehicle on the Ohlone trail to access the in-holding from Calaveras Road; other vehicles are not allowed to use this trail. South of Geary Road near the visitor center for the Sunol Wilderness, there is a year-round EBRPD residence, located about 1.2 miles from Borrow Area D/Dam Vicinity. (See Figure 4.14.1, Noise Measurement and Sensitive Receptor Locations, in Section 4.14, Noise, for the locations of these two residences.)

Under the terms of the *Alameda Watershed Management Plan*, permitted uses on SFPUC primary watershed lands are strictly managed to protect water supply and water quality. The SFPUC permits and manages grazing and recreational/educational/scientific uses on primary watershed lands. Commercial, industrial, utility, agricultural, and recreational uses are permitted on its secondary watershed lands. Public Access Permits or Land Use Permits and Leases from the SFPUC are required for all land uses in the SFPUC Alameda Watershed. In the case of industrial land uses such as quarry/mining operations within the SFPUC watershed, an operator must obtain a Surface Mining Permit from Alameda County under California's Surface Mining and Reclamation Act (SMARA).¹ The terms and conditions of the Alameda County-issued mining permit(s) are subsequently incorporated into the terms and conditions of an SFPUC mining lease.²

Existing land uses in the Sunol area include nurseries, golf courses, the Sunol Water Temple and SFPUC maintenance yard, the Sunol Valley Water Treatment Plant (SVWTP), grazing lands leased to the EBRPD, recreational trails, and quarry/mining operations. Most of these land uses are located in the north and central portions of the SFPUC Alameda Watershed off of Calaveras Road. In the project vicinity, the Calaveras Dam and Reservoir water storage and distribution facility is the dominant land use. Calaveras Dam is located at the northern end of the reservoir. The former Calaveras Test Site is located at the southern end of the reservoir. Prior to 1993, this site was leased to Stanford Research Institute and subsequently to an ordnance device manufacturing company. (The Calaveras Test Site is discussed in detail in Subsection 4.9.1.4, Former Calaveras Test Site, in Section 4.9, Hazards and Hazardous Materials.)

Several support structures are located near the dam and are used for maintenance and operation of the dam and reservoir. These structures are the potassium permanganate building, the

¹ The City and County of San Francisco does not have a SMARA ordinance because there are no quarry/mining operations within San Francisco; however, the state's SMARA applies to all lands in California.

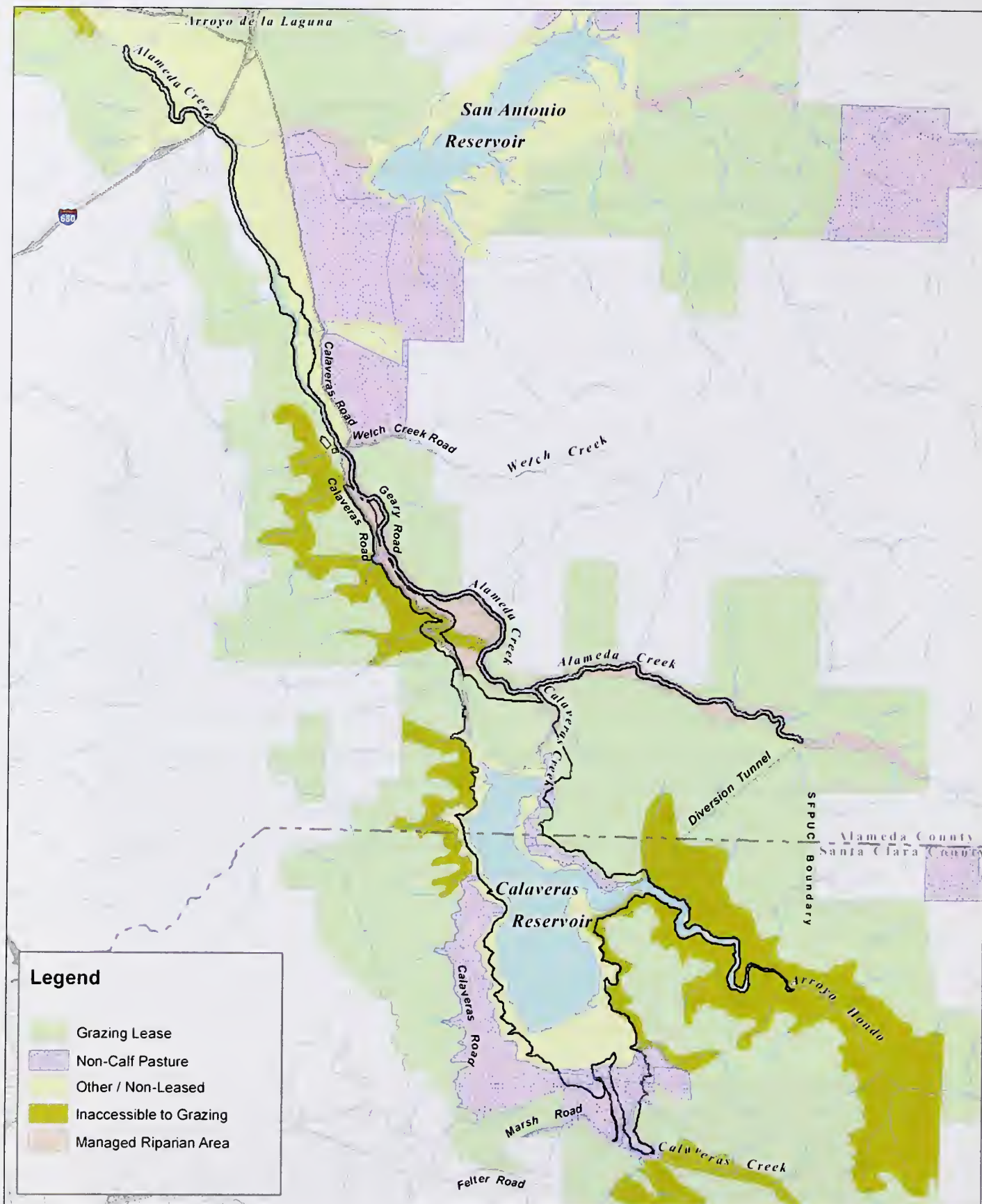
² The SFPUC may impose requirements in addition to those required by Alameda County.

warehouse/compressor building, the bluestone building, and the hypolimnetic oxygenation system (HOS) facilities. The watershed keeper's residence is located south and east near Corral Point.³ (These structures and the watershed keeper's residence are discussed in Subsection 3.3.3, Other Existing Structures, in Chapter 3, Project Description, and in Subsection 4.10.1.5, Known Cultural Resources within the Study Area, in Section 4.10, Cultural Resources.)

4.3.1.4 EXISTING AGRICULTURAL LAND USES

The California Department of Conservation, Division of Land Resource Protection, maps important farmlands throughout California. Important farmlands are divided into five categories based on their suitability for agriculture (CDC 2008, p. 4): (1) Prime Farmland, (2) Farmland of Statewide Importance, (3) Unique Farmland, (4) Farmland of Local Importance, and (5) Grazing Land. Most of the SFPUC-owned lands in both Alameda and Santa Clara Counties are classified as Grazing Land (CDC 2007, 2009). Approximately 32,000 acres of the 36,000 acres of SFPUC-owned watershed lands are used for livestock grazing (see Figure 4.3.2: Grazing Use of SFPUC-Owned Lands). There are, however, some areas of Unique Farmland along a stretch of Alameda Creek between San Antonio Creek and the SVWTP. The Alameda County *East County Area Plan* and the *Santa Clara County General Plan* include agricultural land use designations for two areas in the eastern portion of the SFPUC watershed. These areas are designated "Large Parcel Agricultural" and "Ranchlands," respectively (see Figure 4.3.1). Alameda County has zoned the land north of Calaveras Dam as an agricultural district with an A-B-E – 320 acres (Agricultural, 320-acre minimum) zoning designation. The current uses on this land are parklands and water management, with some limited grazing and nursery operations. Santa Clara County has zoned the land south of Calaveras Dam as an agricultural district with land west of the reservoir (and a small portion on the northeast shore of the reservoir) as an AR-sr combined zoning designation (Agricultural Ranchlands-scenic roads). The lands south and east of the reservoir are in an AR (Agricultural Ranchlands) zoning district. The current uses on this land are water management, with some limited grazing.

³ The SFPUC's Land Use and Resource Management Division has six Alameda Watershed keepers who are responsible for monitoring assigned portions of the watersheds and for providing immediate first-response to emergencies. The watershed keepers' primary function is to protect the watershed and, thereby, the water supply. Their duties include monitoring reservoir and stream levels, monitoring water quality, suppressing fires, removing trespassers, assisting the public, monitoring the watersheds for road and other erosion damage, and checking system facilities immediately after an earthquake.



SOURCE: EDAW & Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.3.2: GRAZING USE OF SFPUC-OWNED LANDS

4.3.1.5 EXISTING RECREATIONAL LAND USES

The primary goal of managing the SFPUC Alameda Watershed is to maintain and improve source water quality to protect public health and safety. Accordingly, public use of these lands is strictly limited. Established recreational uses on SFPUC-owned primary watershed lands are north of the existing dam. The nearest recreational facilities are the EBRPD's Sunol and Ohlone Wilderness areas (see Figure 4.3.3: Recreational Facilities in the Vicinity of the Project Site). The Sunol Wilderness is augmented by approximately 3,800 acres of SFPUC primary watershed lands. These recreational facilities are located northwest, north, and northeast of the existing dam and are accessed via Calaveras Road. Other established recreational facilities in the region include the Ed R. Levin County Park and the EBRPD's Mission Peak Regional Preserve, both located west of the project site, and Del Valle Regional Park, located east of the project site and adjacent to the eastern boundary of the Ohlone Wilderness. Trails on watershed lands are rugged and the intensity of use is low in the dry hot summer. Two 18-hole golf courses at the Sunol Valley Golf Course, used by approximately 88,000 persons per year, are located north of I-680 on SFPUC lands downstream of Calaveras Dam and the confluence of Alameda and Calaveras Creeks (San Francisco Planning Department 2001, p. III.B-3). The Sunol Water Temple is also located north of I-680 on SFPUC lands and is open to the public from 9:00 a.m. to 3:00 p.m. Monday through Friday. In addition, Calaveras Road has been used in the past for regional bicycle races and recreational rides sponsored by local bicycle clubs. The AMGEN Tour of California bicycle race, held in the spring, has included Calaveras Road in the race's early stage routes for the inaugural 2006 Tour, the 2007, and the 2009 Tours; Calaveras Road was not included in the 2008 Tour. The yearly Primavera Century, held in April and sponsored by the Fremont Freewheelers Bicycle Club, has also included Calaveras Road as part of its route.

Individual access to internal roads and fire roads on primary watershed lands is prohibited in all cases except where these lands have been leased to the EBRPD for recreational management and grazing. Access is prohibited because of the risk of fire and the potential degradation of water quality and natural resources. Recreational activities such as boating, fishing, and swimming are prohibited on Calaveras Reservoir. Similar activities are prohibited in and along Calaveras Creek and Arroyo Hondo as well as the upper portions of Alameda Creek. Restrictions on hike-in and vehicular access to interior watershed lands, including stretches of Alameda Creek, are enforced, although permitted groups, accompanied by SFPUC-approved volunteer leaders, are allowed limited access to internal roads and fire roads for research or educational purposes.

Other important recreational resources in the area include the thousands of contiguous acres of park and open space on lands that abut the SFPUC Alameda Watershed. These lands are under the control of the EBRPD and Santa Clara County. Recreational facilities are available in the Sunol Wilderness, the Ohlone Wilderness Regional Preserve (Ohlone Wilderness), Del Valle Regional Park, Mission Peak Regional Preserve, and Ed R. Levin County Park.

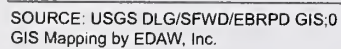


FIGURE 4.3.3: RECREATIONAL FACILITIES IN THE VICINITY OF THE PROJECT SITE

Sunol and Ohlone Wilderness Regional Preserves

The SFPUC currently leases 3,800 acres to the EBRPD as part of the 6,858-acre Sunol Wilderness. The Sunol Wilderness is located between San Antonio Reservoir and Calaveras Reservoir. The remote 9,736-acre Ohlone Wilderness abuts the Sunol Wilderness at its eastern boundary and has limited access. The Sunol and Ohlone Wilderness areas are managed by the EBRPD and are part of the Alameda Creek watershed. Over 200,000 visitors use the Sunol and Ohlone Wilderness areas annually (San Francisco Planning Department 2001, p. III.B-3).

The Sunol Wilderness has over 26 miles of trails for hikers and equestrians and several multi-use trails for hikers, equestrians, and mountain bikers. Recreational facilities and programs include picnic areas, barbecue pits, group and backpack campsites, a visitor's center, naturalist-led activities, and equestrian facilities. At least one camping area is located adjacent to Alameda Creek. Little Yosemite, a scenic gorge on Alameda Creek, is located within the Sunol Wilderness. Swimming is not prohibited within the Sunol Wilderness, except in Little Yosemite. Other water sports, including boating, rafting, and canoeing, generally are not feasible in this portion of Alameda Creek due to the creek's water level, and fishing is not allowed in Alameda Creek. There is an EBRPD residence occupied year round south of Geary Road near the visitor center.

The Ohlone Wilderness has over 42 miles of hiking trails designated for hikers only, with the exception of the Ohlone Wilderness Regional Trail, which accommodates both hikers and equestrians. Access to the Ohlone Trail is by permit only. A segment of a regional trail, Calaveras Ridge Trail – Sunol to Pleasanton Ridge, is proposed to extend north from Sunol Valley through the SFPUC's secondary watershed lands. This trail would connect to a hiking trail located west of Calaveras Road, ultimately connecting the Pleasanton Ridge Regional Park with the Sunol Wilderness (EBRPD 1997, pp. 53 and 56; San Francisco Planning Department 2001, p. III.B-3). Recreational facilities include backpack camps and Camp Ohlone, a permit-only group campsite located along upper Alameda Creek upstream from the Alameda Creek Diversion Dam.

Ohlone Wilderness Regional Trail

The Ohlone Wilderness Regional Trail, managed by the EBRPD, is a 28-mile trail for hikers and equestrians (no bicycles or motor vehicles are permitted) that stretches across and connects, from east to west, the Del Valle Regional Park, the Ohlone Wilderness, the Sunol Wilderness, and the Mission Peak Regional Preserve. It also passes through two watershed areas that the EBRPD leases from the SFPUC. The trail crosses Alameda Creek within the Sunol Wilderness. There are sign-in gates at the eastern (Del Valle) and western (Mission Peak) trailheads and at a trailhead near the Sunol Valley parking area off of Geary Road. A private in-holding developed with a home is located off the Ohlone Trail about 1.3 miles west of its Calaveras Road crossing.

Del Valle Regional Park

The EBRPD's Del Valle Regional Park is located north and east of the project site. The park encompasses approximately 4,000 acres in central Alameda County, about 10 miles south of the City of Livermore off Interstate 580. Del Valle Dam forms Lake Del Valle, the primary feature of the park. The lake stretches for 7 miles and has 16 miles of shoreline. There are over 67 miles of hiking and horseback riding trails, a nature study area, and two swimming beaches with lifeguards. Recreational facilities and programs include picnic areas, barbecue pits, group and backpack camps, a visitor's center, naturalist-led activities, equestrian facilities, boating, fishing, and swimming.

Mission Peak Regional Preserve

The 2,999-acre Mission Peak Regional Preserve is located immediately east of the City of Fremont and abuts SFPUC-owned watershed lands along its eastern boundary and the Ed R. Levin County Park along its southern boundary. The SFPUC-owned watershed lands immediately east of the regional preserve are leased to the EBRPD as part of the Sunol Wilderness. The Mission Peak Regional Preserve has over 20 miles of trails for hikers, cyclists, and equestrians, and is the western terminus of the 28-mile Ohlone Wilderness Regional Trail. In addition, a segment of the Bay Area Ridge Trail travels through the preserve. Mission Peak also includes picnic areas, equestrian facilities, areas for hang-gliding, areas designated for use of remote-controlled aircraft, and a backpack campsite.

Ed R. Levin County Park

The 1,539-acre Ed R. Levin County Park lies on the border of Alameda County and Santa Clara County. The county park surrounds the Spring Valley Golf Course. Portions of its western half are within the City of Milpitas and the eastern edge of the county park borders on SFPUC-owned watershed lands. This park offers picnic and play areas, and 19 miles of trails for hiking, cycling, and horseback riding, including a stretch of the Bay Area Ridge Trail. It also includes areas for fishing and hang gliding.

4.3.1.6 REGULATORY FRAMEWORK

Section 4.2, Plans and Policies, discusses the goals related to land use, agricultural resources, and recreation and the consistency of the proposed project with relevant plans and policies, including the *Alameda Watershed Management Plan*.

The *Alameda Watershed Management Plan* goals, policies, and management actions identify and govern appropriate activities, practices, and procedures on the SFPUC's Alameda Watershed lands. Policies of the Plan relevant to land use, agricultural resources, and recreation are identified below.

Water Quality

- Policy WQ1.1: Avoid disturbance to and location of activities on lands with the High Water Quality Vulnerability Zone to reduce the possibility of water quality impacts. At a minimum maintain a 300-foot disturbance-free buffer around all waterbodies and streams.
- Policy WQ30: Require intensive management and ongoing monitoring of land uses and activities that could result in the introduction of pathogens into the water supply.

Watershed Activities

- Policy WA1: Prohibit activities which are detrimental to watershed resources. Prohibited activities are as follows:
 - C. Swimming and body contact with the water by humans and domestic animals.
 - E. Boating with the exception of SFPUC maintenance, operations, and monitoring activities and in selected emergency storage reservoirs.
 - F. Activities which result in direct public access to reservoirs and tributaries (e.g., fishing, new trails at or near shoreline).
 - K. Use of the watershed during periods of extreme fire weather conditions.
 - L. Hunting.
 - P. Fishing, except as authorized by the SFPUC.
 - R. Unsupervised public access to all existing internal roads/fire roads and trails.
 - T. Off-trail use by recreational users.
 - U. Unauthorized construction of new trails.
- Policy WA2: Prohibit the construction of new trails and unsupervised access to existing roads and trails not addressed in this Plan.
- Policy WA10: The activities listed below shall be allowed on the watershed by SFPUC permit only. Unless otherwise stated, permits shall be limited to one day per permit and for day use hours only. Activities allowed by permit only are:
 - A. Overnight use.
 - B. Off-trail activities.
 - H. Use of Sunol Water Temple for wedding ceremonies, lectures, meetings, etc.
 - K. Supervised public access to existing internal roads/fire roads and trails.
 - L. Research/scientific study by non-SFPUC personnel.
 - M. Educational activities.
 - N. Hunting for, and control of, pest species.
- Policy WA11: Allow access by permit to select areas of the watershed generally closed to the public for scientific research by institution, agencies, and groups which is compatible with water quality protection and all applicable watershed management plans goals and policies.

- Policy WA12: Allow supervised access by permit to select areas of the watershed generally closed to the public for educational activities.
- Policy WA15.1: Existing public trails as of January 2000 shall remain open to individuals and groups without a permit except where a permit is currently required.
- Policy WA15.3: Retain existing public trails, defined as public trails as of January 2000, and the activities allowed upon them. Encourage the most active trail use upon these trails.

The *Alameda Watershed Management Plan* also includes management actions, specific tasks that guide SFPUC staff, SFPUC Land and Resources Management staff, and, by extension, lessees of SFPUC land in the day-to-day activities that support *Alameda Watershed Management Plan* goals and policies. Relevant management actions related to land use, agricultural resources, and recreation are as follows:

- **Action lea3** requires that all new and renewed leases and easement agreements include restrictions on activities in the High Water Quality Vulnerability Zones and, at a minimum, require that activities in this zone be located at least 300 feet away from any stream or water body in order to protect water quality.
- **Action gra1** calls for the implementation of grazing management controls to: (1) reduce the risk of viable pathogen discharges into watershed streams and reservoirs by enhancing the health of the riparian zones and reservoir margins; and (2) maintain and improve ecological resources in other areas of the watershed by ensuring that vegetation growth will be kept under control.
- **Action gra2** calls for the implementation of structural protection measures to: (1) reduce the risk of viable pathogen discharges into watershed streams and reservoirs by enhancing the health of the riparian zones and reservoir margins; and (2) maintain and improve ecological resources in other areas of the watershed by ensuring that vegetation growth will be kept under control. Requirements for implementing the structural protection measures include the following:
 - A. Strategically placed fencing around reservoirs and streams restricting all cattle access, and around riparian pastures restricting access by calves. Fencing shall be provided to restrict access by cattle to these areas while at the same time providing for adequate wildlife access, and decreasing the potential for established cattle trails. Such trails eventually become erosion channels. Fencing to restrict cattle from these areas shall be constructed using barb wire with top wire not more than 42 inches above the ground and smooth bottom wire at least 18 inches above the ground.
- **Action gra5** calls for the implementation of a set of lease requirements and terms to establish stocking rate requirements, annual operating plans, water quality protection measures, timing of calving, staffing requirements, fee structure, and specific lease terms. The following lease requirements and terms must be adhered to:
 - B. Annual Operating Plans – Annual Operating Plans will be prepared and submitted by the lessee for each grazing unit by October 1 annually. The annual operating plan will reflect the number of AUMs [Animal Unit Months] to be stocked on each grazing unit based on current forage conditions. It will also include an RDM [residual dry matter] target level for May 15 annually for the AUM specified. The

plan will also identify the tenant's season of use, specific watershed improvement requirements, herd health plan, pest control actions, fiscal requirements, verification of security measures including insurance requirements, and pre-approved tenant improvement credits.

E. Staffing – Each lessee will be required to maintain an active presence on the property. At a minimum, one full-time staff person will be required on site to manage each grazing unit.

- **Action gra7** calls for the implementation of improvements for the Calaveras Watershed Protection Area. These improvements are considered the second priority of the three Alameda Creek Watershed Protection Areas. The area consists of one reservoir and one stream zone buffer, several inaccessible (too steep for cattle) zones, three riparian pastures, and three general grazing units. Improvements for this area included fencing, water developments, water collection systems, stream crossings, wildlife ponds, and stock pond rehabilitation.

The Calaveras Dam Replacement Project (CDRP) is located on SFPUC lands within Alameda and Santa Clara Counties. The line dividing Alameda and Santa Clara Counties runs east to west through the northern portion of the Calaveras Reservoir.

The *Alameda Watershed Management Plan* goals and policies that focus on the protection of watershed lands, agricultural lands, biological resources, and open space, as well as the provision of recreational opportunities, are also documented in the general plans of Alameda and Santa Clara Counties and the *East Bay Regional Park District Master Plan*. The goals and policies of the *East County Area Plan* (Alameda County), *General Plan Book B* (Santa Clara County), and the *East Bay Regional Park District Master Plan* are similar to and consistent with the SFPUC's goals of protecting water supplies and water quality.

The county-assigned land use designations for both the SFPUC-owned watershed lands and for adjacent county lands encourage inter-jurisdictional efforts to protect the watershed's water supply and water quality. The majority of the SFPUC-owned lands are designated as Water Management (Alameda County) and Other Public Open Lands (Santa Clara County). Adjacent county lands are designated for parks, resource management, and agriculture.

4.3.2 IMPACTS

This section discusses the changes in land use, agricultural resources, and recreation in the proposed project area that would result from the construction of the replacement dam. This section also discusses the compatibility of the replacement dam with existing land uses in the vicinity. The significance criteria for each of the subtopics analyzed in this section are identified under their respective headings.

4.3.2.1 APPROACH TO ANALYSIS

The physical changes resulting from the proposed project during both construction and operation were compared to the baseline conditions described above. Any project-related changes that result in an exceedance of the significance criteria described below under the land use, agricultural resources, and recreation analysis are considered significant impacts. Where applicable, mitigation measures are identified to reduce significant impacts to a less-than-significant level.

4.3.2.2 SUMMARY OF IMPACTS

Table 4.3.1 summarizes the project-related impacts on land use, agricultural resources, and recreation described in this section.

Table 4.3.1: Summary of Land Use, Agricultural Resources, and Recreation Impacts

Impact	Level of Significance
Land Use	
4.3.1: Impact of construction activities on the existing character of the vicinity of the proposed project.	LS
4.3.2: Impact of project operations on existing and/or planned land uses in the vicinity of proposed facilities.	LS
4.3.3: Consistency of proposed project with applicable land use plans, policies, and regulations adopted to avoid environmental impacts.	LS
Agricultural Resources	
4.3.4: Impact of construction activities on grazing land.	LS
4.3.5: Impact of project operations on agricultural uses in the project vicinity.	LS
Recreation	
4.3.6: Impact of construction activities on established recreational uses in the vicinity of the proposed project site.	LSM
<i>Notes:</i> LS – Less than significant LSM – Less than significant with mitigation	

4.3.2.3 LAND USE

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to land use, but generally considers that implementation of the proposed project would have significant impacts on land use if it were to:

- Physically divide an existing community;
- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the general plan, specific plan, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect; or
- Have a substantial impact on the existing character of the vicinity.

The proposed project is not in the immediate vicinity of sensitive developed land uses. The proposed replacement of Calaveras Dam and its support facilities would occur in an undeveloped area managed for water storage and water quality. Public access and recreation is restricted in the vicinity of the project site and on all SFPUC primary watershed lands. The proposed project would essentially relocate and rebuild an existing dam slightly to the north of its current location, while all surrounding land uses, including the reservoir, agricultural/grazing lands, and recreational uses, would remain unchanged. Since the project would not physically divide an existing community there would be no significant impact under the first significance criterion.

Project Impacts

Impact 4.3.1: Impact of construction activities on the existing character of the vicinity of the proposed project.

Calaveras Dam and Reservoir are surrounded by SFPUC-owned watershed lands. Existing land uses along Calaveras Road in the northern and western portion of the SFPUC-owned watershed lands include grazing, nurseries, quarrying/mining operations, a pump station, a water treatment plant, and hiking/picnicking. Rural residential land uses are present along Felter Road, Welch Creek Road, Geary Road, and the private in-holding off the Ohlone Wilderness Regional Trail. Private lands and unincorporated county lands surrounding the SFPUC watershed are rural in character, e.g., large-lot residential enclaves, agricultural parcels, and wilderness areas. The town of Sunol is almost 8 miles north of the existing dam. All of these land uses exist in a generally rural setting that has low volumes of truck traffic, with the exception of I-680.

Construction activities would include, but would not be limited to, blasting, demolition, excavation, grading, and recontouring. In addition, the SFPUC would request permission from Alameda and Santa Clara Counties to close portions of Calaveras Road for two periods (the first period would be approximately 2 months and the second approximately 18 months) and would be subject to short-term closures or delays throughout the construction period. Construction activities would generate temporary increases in dust and noise levels; would affect the visual quality of the landscape as viewed from different areas of the watershed; and would generate construction-related traffic leading to an increase in traffic volumes on local roads. These project-related activities would temporarily affect the character of the project vicinity.

The existing character of the vicinity is influenced by traffic and other activities associated with the operation and maintenance of the existing quarries, SFPUC regional water system facilities, and nurseries in the vicinity. While the scale of the construction-related activities associated with the proposed project would be greater than the activities that occur now, they would not directly impact the character of land uses in the project vicinity due to the substantial distance. Further, any indirect project effects, such as those resulting from increased construction traffic, would be similar to ongoing activities that occur in the vicinity; all existing land uses would continue to operate uninterrupted throughout the construction period, including the existing dam, which would continue to operate under restricted conditions. Existing land uses on the dam site, all of which are directly related to the operation of the dam, would not be affected by construction. The construction-related activities associated with the proposed project would be temporary and would have no permanent or lasting effect on the character of the vicinity once construction is complete.

Impact Conclusion

The temporary increase in construction-related activities resulting from the proposed project would not substantially alter the existing character in the vicinity. Therefore, the temporary impacts on the existing character of the vicinity would be less than significant.

Impact 4.3.2: Impact of project operations on existing and/or planned land uses in the vicinity of proposed facilities.

Operation of the proposed dam and reservoir would continue existing uses at Calaveras Dam and Reservoir. The replacement dam would allow for increased water storage levels in Calaveras Reservoir. Long-term operation of Calaveras Dam and Reservoir would be similar to current operations. There are no proposed permanent changes to land uses in the vicinity of the proposed project. Existing land uses surrounding the project area would continue during and after construction. No change in planned land uses would be required as a result of project construction and operation. Access to open space and recreational use of watershed lands would remain limited, and grazing would continue.

Impact Conclusion

As the proposed project would be consistent with existing and planned land uses, potential impacts associated with long-term land use compatibility would be less than significant.

Impact 4.3.3: Consistency of proposed project with applicable land use plans, policies, and regulations adopted to avoid environmental impacts.

As noted previously, the goals and policies of the *East County Area Plan* (Alameda County), *General Plan Book B* (Santa Clara County), and the *East Bay Regional Park District Master Plan*

are similar to and consistent with the SFPUC's goals of protecting water supplies and water quality. The county-assigned land use designations for both the SFPUC-owned watershed lands and for adjacent county lands encourage inter-jurisdictional efforts to protect the watershed's water supply and water quality. Allowed uses under these land use designations and the goals and policies set forth in the adopted planning documents of adjacent jurisdictions are generally similar to the aims of the *Alameda Watershed Management Plan* and have been considered in the design of the CDRP. Thus, the proposed project would be consistent with local land use plans and policies.

Although construction of the CDRP would not occur on land under the jurisdiction of Alameda County, Santa Clara County, or the EBRPD, blasting, excavation, and other activities related to construction of the replacement dam would result in temporary limitations on allowed recreational activities on adjacent lands, such as hiking on trails in the Sunol Wilderness. (Blasting activities are discussed in more detail in Section 4.9, Hazards and Hazardous Materials, and Section 4.13, Air Quality.) Although these limitations would reduce recreational access to SFPUC-owned watershed lands and EBRPD-managed lands, the conflict with plans and policies supporting recreational access would be temporary and limited. Additionally, the long-term operational characteristics of the replacement dam would not differ from current operations, and existing land uses and associated activities would not change. Therefore, policy conflicts between CDRP activities and the plans, policies, and regulations of adjacent jurisdictions are not anticipated.

Impact Conclusion

Coordination between the SFPUC and adjacent jurisdictions is and has been part of ongoing regional efforts to protect the Alameda Creek watershed. These efforts include working cooperatively with these jurisdictions to support continuation of existing recreational opportunities and limited expansion onto SFPUC lands. Construction of the CDRP and its future operation would not result in any permanent conflicts with the strategies, goals, or policies applicable to SFPUC-owned lands or adjacent county lands. Therefore, this impact would be less than significant.

4.3.2.4 AGRICULTURAL RESOURCES

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to agricultural resources, but generally considers that implementation of the proposed project would have significant impacts on these resources if it were to:

- Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance, as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use;
- Conflict with existing zoning for agricultural use or a Williamson Act contract; or
- Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland of Statewide Importance to non-agricultural use.

Project Impacts

Impact 4.3.4: Impact of construction activities on grazing land.

The 36,000-acre SFPUC Alameda Watershed does not include lands identified as Prime Farmland or Farmland of Statewide Importance nor does it include lands protected under the Williamson Act. Areas of Unique Farmland are located along Alameda Creek between San Antonio Creek and the SVWTP. The areas of Unique Farmland identified along the Alameda Creek bottomlands are outside of the project site boundary and would not be affected by the proposed project. There is no Prime Farmland, Farmland of Statewide Importance, or areas of Unique Farmland located on SFPUC watershed lands that were formerly inundated, i.e., along the current shoreline. Therefore, the proposed project would not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Significance to non-agricultural uses or conflict with any Williamson Act contracts. Alameda County's A-B-E zoning district and Santa Clara County's AR and AR-sr zoning districts for the proposed project land and the land surrounding the proposed project would not change as a result of the proposed project. Although the CDRP project would temporarily limit grazing on a portion of the watershed, as described below, the CDRP would not conflict with existing zoning for agricultural use.

The project could result in a temporary reduction in the total acreage available for grazing in the watershed. Livestock grazing is a long-term existing use of SFPUC-owned watershed lands and is part of the watershed's and surrounding area's existing condition. Livestock grazing is an allowed use on 32,000 acres of the watershed during various times of the year. Only areas currently leased for grazing that overlap with areas that would be disturbed as a result of construction activities would be affected. The proposed project would temporarily remove from grazing about 137 acres of leased grazing land during the construction period of approximately 4 years.⁴

⁴ The acreage to be removed from grazing as a result of construction activities includes areas that do not support grazing due to the presence of slopes that exceed 60 percent; rock outcroppings; and fencing to restrict grazing in riparian areas. Therefore, the estimate is a worst-case scenario.

Before the project begins, annual operating plans for grazing leases affected by the proposed project would be developed or revised to avoid the approximately 137 acres of grazing land that would be disturbed by disposal sites, borrow areas, access roads, and staging areas. Upon completion of the proposed project, disturbed areas would be restored (see Section 5.4, Vegetation and Wildlife, in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project). Restored grassland would grow the most quickly, while riparian forest and upland woodland habitats could take more than a decade to become re-established. Woodland restoration would be undertaken for ecological and watershed protection reasons. Grazing in identified riparian and upland woodland restoration areas would therefore remain restricted so that oak seedlings and other sensitive species of flora could become established.

Impact Conclusion

Because most of the SFPUC land would remain available for grazing under existing leases, the temporary loss of approximately 137 acres of leased grazing land would be less than significant. There are no other agricultural uses on the project site, and the proposed project would not convert designated agricultural areas to non-agricultural uses. Therefore the impact on agricultural uses would be less than significant.

Impact 4.3.5: Impact of project operations on agricultural uses in the project vicinity.

Existing agricultural uses on SFPUC-owned primary watershed lands are limited to grazing and nursery operations. Operations of the proposed CDRP would not affect the existing nurseries in the Sunol Valley. A reservoir buffer zone restricts grazing within 300 feet of Calaveras Reservoir to protect the water quality of the reservoir

The proposed project would not result in a change in land use or a change in the intensity of existing uses that could result in conversion of farmland to non-agricultural use. Livestock grazing would continue as an allowed use on SFPUC-owned watershed lands. However, implementation of mitigation measures for vegetation and wildlife may result in post-construction restrictions on livestock grazing at Disposal Sites 3 and 7, Borrow Area B, and Staging Areas 1 through 11, and along the routes of the access roads. These restrictions would be temporary and would be lifted when grassland, riparian forest, and upland woodland restoration activities are complete and vegetation is well established. Permitted uses on SFPUC-owned secondary watershed lands would also continue.

Upon completion of the proposed project, the DSOD-restricted reservoir level would no longer be in effect; thus, the inundation pattern that existed before the DSOD restrictions would return. This would result in an increase in the level of the reservoir from 705 feet to 756 feet, inundating areas along the existing shoreline. The 300-foot reservoir buffer zone is located on land that is

not leased for grazing and did not change in response to the DSOD order to lower the reservoir level. As a result, there would be no permanent change in the amount of land available for agricultural use.

Impact Conclusion

The proposed construction and operation of the replacement dam would have a less-than-significant impact on agricultural resources.

4.3.2.5 RECREATION

Significance Criteria

The City and County of San Francisco has not formally adopted significance standards for impacts related to recreation, but generally considers that implementation of the proposed project would have significant impacts on recreational resources if it were to:

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facilities would occur or be accelerated;
- Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment; or
- Physically degrade existing recreational resources.

The proposed project would not increase the use of existing neighborhood or regional parks or other recreational facilities nor include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment. Therefore, the first and second significance criteria would not be applicable. The proposed project would not cause direct physical degradation of existing recreational resources. However, as discussed below, the proposed project would result in temporary indirect effects that could degrade existing recreational resources due to construction-related visual, noise, dust, and traffic impacts.

Project Impacts

Impact 4.3.6: Impact of construction activities on established recreational uses in the vicinity of the proposed project site.

Project-related construction activities would be limited to the construction staging areas along Calaveras Road near its intersection with the dam access road, construction staging areas near the existing dam facility, disposal sites and borrow areas at the location of and adjacent to the existing dam facility, a disposal site south of the existing dam, and a borrow area south of Calaveras Reservoir. It is possible that construction equipment might damage Calaveras Road.

Should such damage occur, the SFPUC would repair the road to its original condition, in accordance with Mitigation Measure 5.12.4a (see Section 5.12, Transportation and Circulation, in Chapter 5). Implementation of this mitigation measure would reduce the impact to a less-than-significant level.

Blasting, which would be limited to weekdays, and other construction activities could increase local dust levels. Emissions of particulate matter (PM) from dust and dust contain naturally occurring asbestos (NOA) and metals could be hazardous to hikers using trails in the Sunol Wilderness near the construction areas and to recreational bicyclists using Calaveras Road (see Sections 4.9 and 4.13, Hazards and Hazardous Materials and Air Quality). Bay Area Air Quality Management District regulations prohibit construction activities in NOA containing areas from resulting in visible dust beyond the project site boundaries, and require dust control measures to reduce impacts on Air Quality from PM emissions. In accordance with these regulations, Mitigation Measures 5.9.2a and 5.13.1a require implementation of dust control measures to reduce emissions of NOA, metals and PM during project construction. In addition, Mitigation Measure 5.9.2a includes monitoring requirements to ensure that dust is effectively controlled and corrective actions, including temporary suspension of work, if needed to prevent impacts on offsite receptors. These dust control measures are designed to prevent emissions of NOA, metals and PM in accordance with the applicable regulatory requirements, and implementation of these measures is expected to prevent impacts from construction-related dust on recreational hikers and bicyclists. However, offsite emissions of dust due to unexpected conditions such as extraordinarily high winds could pose a potential hazard to recreational hikers or bicyclists despite the required dust control measures. In the unlikely event of such an occurrence, temporary trail and/or road closures could be requested by the SFPUC based on air quality monitoring. In such an event, Mitigation Measure 5.9.2a requires the SFPUC to coordinate with EBRPD and Alameda County to determine corrective actions that may include signage, other notification, or temporary closures. Implementation of these mitigation measures would reduce the potential impacts of dust from construction activities and related hazards on recreational uses to a less-than-significant level.

Construction-related noise could affect recreational hikers in the Sunol Regional Wilderness and would degrade the wilderness setting of this area. However, this effect would be temporary and hikers and bicyclists would be affected for a limited duration while they passed by the construction areas. Hikers and bicyclists would also be able to avoid the affected areas during project construction. For these reasons, impacts from construction-related noise on recreational resources would be less than significant. However, the SFPUC proposes to coordinate with the EBRPD to provide information signs at the trailheads of affected trails so that hikers may choose to use alternative trails if they wish to avoid construction noise.

Clearing and grading for construction staging, disposal, and extraction areas would also change the visual character of the landscape. These activities may affect the quality of the recreational experience. Visual resources, air quality, and noise impacts are discussed in greater detail in Section 4.11, Visual Resources; Section 4.9, Hazards and Hazardous Materials, Section 4.13, Air Quality; and Section 4.14, Noise and Vibration.

Calaveras Road north of the dam, i.e., between I-680 and the dam access road, would be used as the major hauling route for imported materials for dam construction. For traffic safety reasons, the SFPUC would request permission from Alameda County to close the section of Calaveras Road between a point immediately south of the intersection with Geary Road (south of the SVWTP) and a point near the Santa Clara County line (south of the dam access road) Felter Road (at the south end of the reservoir) to the public, Monday through Friday except for emergency vehicles, for hauling of the imported materials for the dam during two periods. In addition, the SFPUC would request permission from Santa Clara County to close the portion of the road between the Alameda County line and Felter Road during the same two periods. The road would be closed on weekdays for approximately 2 months in summer 2011, then reopened. The second closure period would last for approximately 18 months on weekdays beginning in winter 2012. This section of the road may be closed at other times, including weekend days, when air quality monitoring indicates unacceptable levels of dust (see Section 4.9, Hazards and Hazardous Materials, for further discussion). The section of Calaveras Road north of Geary Road would remain open during construction and would be used by both private and construction vehicles.

Calaveras and Geary Roads provide access to recreational facilities in the Sunol and Ohlone Wilderness areas, including Little Yosemite and Camp Ohlone (see Figure 4.3.3). The weekday closure of Calaveras Road between Geary Road and Felter Road for the two periods in 2011 and 2012 is not expected to limit access to these facilities on most weekend days. However, the Calaveras Road closure would require weekday users of the Sunol and Ohlone Wilderness areas to access these facilities via Calaveras Road from the north using I-680 or State Route 84, rather than traveling northbound on Calaveras Road from the Milpitas area. Although construction activities would take place almost continuously 7 days a week, creating local congestion, construction-related traffic would be reduced on weekends when recreational use of these facilities is greatest. Because these disruptions to recreational access would be temporary, and alternate routes to these recreational facilities would continue to be available, this impact would be less than significant.

The closure of Calaveras Road is not expected to limit recreational use of the Ed R. Levin County Park and the EBRPD's Mission Peak Regional Preserve and Del Valle Regional Park facilities. These recreational facilities would not be affected by the proposed project because of their distance from the proposed construction activities. Roads that lead to these park entrances are not

part of the network of roads that would accommodate the project-related increase in traffic or would be closed during any portion of the construction period of approximately 4 years.

The limited closure of Calaveras Road could temporarily restrict cyclists' use of the road and could require that established professional race and tour routes and routes used by local clubs that include Calaveras Road use alternate routes during the 2-month closure period in 2011 and the 18-month closure period beginning in winter 2012. If the planners for the AMGEN Tour of California were to locate a future cycling stage route on Calaveras Road during the road closure, the resulting conflict with the AMGEN Tour would have a significant recreational impact. To avoid this potential impact, Mitigation Measure 5.3.6 requires the SFPUC coordinate with the AMGEN Tour organizers to ensure that such a stage will be accommodated (i.e., the road will be open that day and free of potential construction debris). With the implementation of Mitigation Measure 5.3.6, and because the disruption to recreational access would be temporary and limited to weekdays, and alternate bicycle routes would be available, this impact would be less than significant.

Impact Conclusion

The temporary impacts of the proposed project on recreational use of facilities in the Sunol and Ohlone Wilderness areas and use of Calaveras Road by cyclists would be reduced to less than significant levels based on the availability of alternate access routes and alternate bicycle routes, the SFPUC plan to open Calaveras Road on weekends, and the implementation of Mitigation Measure 5.3.6 requiring the SFPUC to accommodate the AMGEN Tour if it chooses Calaveras Road as part of its route during a closure period. With implementation of Mitigation Measure 5.12.4a for impacts related to potential road damage and traffic, and Mitigation Measures 5.9.2a and 5.13.1a for dust control impacts on recreational uses of EBRPD trails and Calaveras Road would be reduced to a less-than-significant level.

REFERENCES

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San Francisco Planning Department. 2001. *Alameda Watershed Management Plan Environmental Impact Report*. Prepared by Environmental Science Associates. January 2001.

ADDITIONAL SOURCES CONSULTED

San Francisco Public Utilities Commission. 2001. *Final Alameda Watershed Management Plan*. Prepared by EDAW, Inc. in association with Environmental Science Associates, Montgomery Watson, Public Affairs Management, and Wildland Resource Management. April 2001.

4.4 VEGETATION AND WILDLIFE

Section 4.4 Contents	
4.4.1	Setting
4.4.1.1	Existing Conditions
4.4.1.2	Special-Status Plant and Wildlife Species
4.4.1.3	Regulatory Framework
4.4.2	Impacts
4.4.2.1	Significance Criteria
4.4.2.2	Approach to Analysis
4.4.2.3	Project Impacts

This section addresses terrestrial biological resources that could be affected by implementation of the project. Aquatic biological resources are addressed in Section 4.5, Fisheries and Aquatic Habitat. The terrestrial biological resources investigation for this Environmental Impact Report (EIR) involved literature and database review; consultation with natural resources specialists; and field surveys and Geographic Information System (GIS) mapping of botanical and wildlife resources.

STUDY AREA

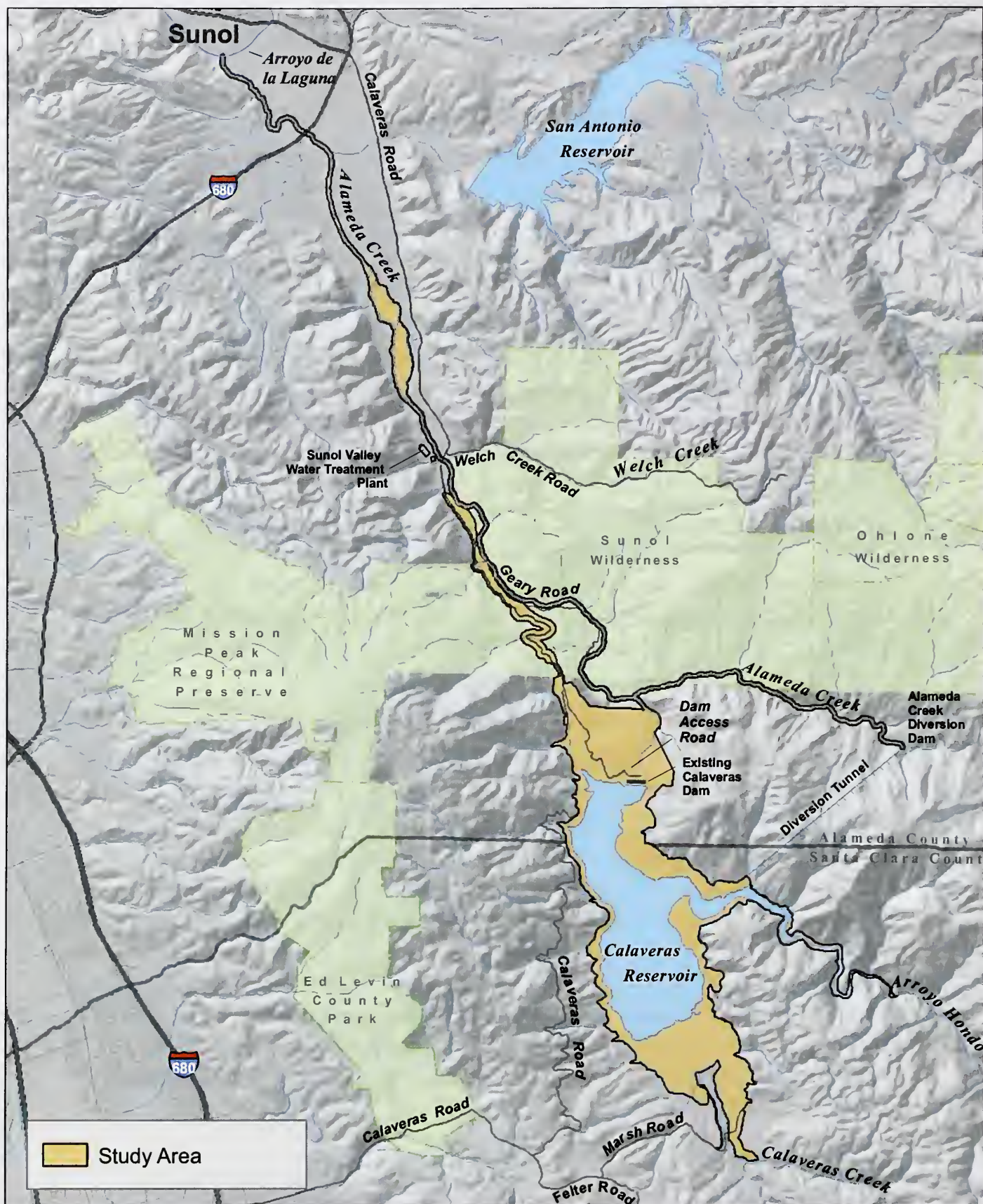
The 1,857-acre vegetation and wildlife primary study area for the *Calaveras Dam Replacement Project Draft EIR* (shown in Figure 4.4.1, Vegetation and Wildlife Study Area) is based on three major elements:

1. The project footprint;
2. The restored Calaveras Reservoir impoundment area; and
3. Streams downstream of the proposed dam facilities that could be affected by operation of the proposed dam.

Field studies for the *Calaveras Dam Replacement Project Draft EIR* began in spring 2006, early in the project design and planning.¹ Over time the project footprint was modified in order to minimize or avoid impacts. Where the project area was shifted or reduced during the development of the proposed project (see Chapter 3, Project Description), the study area was modified to include all changes.² The project footprint is defined by the location of the new dam and spillway, support buildings, haul roads, road improvements, and staging, stockpile, borrow, and disposal sites. The location of the Alameda Creek Diversion Dam (ACDD) bypass is also included in the project footprint. Mitigation sites also are described in Section 5.4, Vegetation and Wildlife, in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project.

¹ Prior to initiation of work on the Draft EIR, field surveys were initiated by the SFPUC in 2003 to help guide alternatives analysis and preliminary design, with the specific goal of minimizing or avoiding potential impacts associated with the project.

² To maximize the availability of biological information collected as part of the environmental review process, all portions of the study area are presented in this EIR, including areas that are no longer proposed for use in the project. In other words, the limits of work for the proposed project (Figure 3.8, Work Limit Area) are narrower than the study area (Figure 4.4.1, Vegetation and Wildlife Study Area).



SOURCE: ETJV 2006b.

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.4.1: VEGETATION AND WILDLIFE STUDY AREA

The restored Calaveras Reservoir impoundment area includes the area that would be directly affected by restoring the pre-DSOD restricted elevation of the reservoir from Elevation 705 feet to 756 feet after construction of the new dam.³ The impoundment area also includes portions of tributaries (e.g., Arroyo Hondo, upper Calaveras Creek, and other intermittent streams) that would be inundated when the reservoir is at maximum capacity but would otherwise not be permanently altered during construction. Portions of the construction footprint would be inundated by the reservoir after it fills.

Streams downstream of the dam facilities could be indirectly affected by operation of the proposed dam. This includes Calaveras Creek from the downstream edge of the project footprint to the confluence with Alameda Creek, and Alameda Creek from the existing ACDD downstream to the confluence with Arroyo de la Laguna. The Alameda Creek corridor was defined based on the potential influence of project operations on streamflows. The ACDD, which diverts water from Alameda Creek for storage in Calaveras Reservoir, is an integral part of Calaveras Reservoir operations. The ACDD is a concrete structure that is bounded by cutoff walls both upstream and downstream and sits on a concrete apron formed into the bed of upper Alameda Creek. Upstream of the ACDD, Alameda Creek has no human-made barriers that impede flows. The primary study area in the Alameda Creek corridor terminates downstream at the Arroyo de la Laguna confluence because the proposed Calaveras Dam operations would have limited influence on flows downstream of the confluence (the extended study area). In addition, the effects of Alameda Creek flows could not be distinguished from runoff flowing out of Livermore Valley and Delta water imported by the Alameda County Water District and discharged into the Arroyo de la Laguna from the South Bay Aqueduct Vallecitos turnout. More detailed discussion of Alameda Creek flows at the Arroyo de la Laguna confluence is presented in Subsection 4.5.1.1, Existing Conditions, in Section 4.5, Fisheries and Aquatic Habitat.

The extended study area (described in more detail in Section 4.5, Fisheries and Aquatic Habitat) extends downstream from the Alameda Creek confluence with Arroyo de la Laguna. For purposes of the vegetation and wildlife impact assessment, the extended study area includes only the riparian corridor along Alameda Creek because no potential exists for project-related impacts to occur beyond the immediate stream channel. Discussion of the aquatic wildlife and riparian vegetation in the extended study area is based on a literature review and aerial photography interpretation.

LITERATURE AND DATABASE REVIEW

The literature reviewed for this section includes numerous documents prepared by the San Francisco Public Utilities Commission (SFPUC) or its consultants. The primary documents

³ While the nominal existing reservoir pool is Elevation 705 feet under the DSOD restriction, Elevation 715 feet represents the ordinary high water as established by the Wetlands and Waters of the U.S. delineation in 2006.

reviewed by the EDAW & Turnstone Joint Venture (ETJV) include a Draft Biological Inventory Report for the *Draft Alameda Watershed Habitat Conservation Plan* (draft AWHCP) (Jones & Stokes 2006), the *Alameda Watershed Management Plan* (SFPUC 2001), aquatic resource monitoring reports (SFPUC unpublished data), the California Department of Fish and Game (CDFG) Response Letter to the project's Notice of Preparation (NOP) (CDFG 2005a) (Appendix B, Letter #9), Alameda Creek Alliance (ACA) Response Letter to the project's NOP (ACA 2005), and several technical reports that address special-status plant and wildlife species.

The California Natural Diversity Database (CNDDB) (CNDDB 2009a, 2009b) and California Native Plant Society (CNPS 2009) Electronic Inventory of Rare and Endangered Vascular Plants of California were reviewed for documented occurrences of special-status species in the vicinity of the study area. An updated list of federal endangered and threatened species that may be affected by projects in the Calaveras Reservoir, La Costa Valley, and Niles U.S. Geological Survey (USGS) 7.5-Minute Quadrangles was obtained from the U.S. Fish and Wildlife Service (USFWS) website (USFWS 2009) and reviewed.

CONSULTATION WITH BIOLOGICAL RESOURCE AGENCIES AND RESOURCE SPECIALISTS

ETJV biologists met with the USFWS, National Marine Fisheries Service (NMFS) and CDFG biologists on February 9, 2006 to review the Calaveras Dam Replacement Project (CDRP) biological survey program. That review included survey approach and schedule, summary of work completed to date, and planned additional surveys, technical report preparation, and agency consultation. A number of meetings with USFWS and CDFG biologists also occurred in the field in 2007 to discuss mitigation areas and approaches. Additionally, updates of approaches to the impact assessment and preliminary results were presented to and discussed with the agencies in late 2007 and in 2008, including USFWS, CDFG, U.S. Army Corps of Engineers (USACE), and San Francisco Bay Regional Water Quality Control Board (RWQCB).

ETJV biologists met with East Bay Regional Park District (EBRPD) biologists on June 14 and July 18, 2006 to discuss potential wildlife impacts of the project and conducted follow-up discussions via telephone and email. EBRPD biologists have extensively studied wildlife on lands they manage, which includes some SFPUC-owned lands in the study area. Following the discovery of a pair of nesting bald eagles at Calaveras Reservoir in the spring of 2006, ETJV biologists consulted Hans Peeters, a local ornithologist specializing in raptors (Peeters, pers. com.), and Kelly Sorenson, Executive Director of the Ventana Wildlife Society, regarding prior bald eagle use of the study area (Sorenson, pers.com.).

CDFG requested that the CDRP Draft EIR include the Berkeley kangaroo rat as a species potentially present in the project area (CDFG 2005a, p. 2). Local experts on the species, Dr. Jim Patton, Professor emeritus, University of California, Berkeley, and Gary Beeman, a local

biological consultant, were consulted in 2006 and 2007 by telephone and email and in meetings regarding Berkeley kangaroo rat taxonomy, distribution, and genetic analysis. ETJV biologists also corresponded with CDFG by email in 2007 regarding the development and implementation of a Berkeley kangaroo rat survey protocol.

FIELD SURVEYS

Biological surveys were conducted in 2006, 2007, 2008, and 2009 to identify sensitive terrestrial and aquatic biological resources within the study area. Aquatic resource surveys included habitat descriptions, fish barrier analyses, and hydrologic modeling (see Section 4.5, Fisheries and Aquatic Habitat, for more details). Terrestrial surveys were based on the results of reconnaissance surveys and focused on identifying and evaluating potential habitat rather than on determining the presence or absence of any particular species. In some cases (e.g., for federally endangered or threatened butterflies), surveys were designed to increase the precision of prior studies conducted at a regional scale (e.g., the *Alameda Watershed Habitat Conservation Plan*).

In the spring and summer of 2006 and spring of 2007, ETJV biologists mapped vegetation/habitats and wetlands in the study area (ETJV 2006b), mapped sensitive butterfly habitat, conducted focused avian studies, and conducted habitat assessments for California red-legged frog, California tiger salamander, and Berkeley kangaroo rat. Sightings of sensitive species by ETJV biologists were mapped using GIS; these sightings were compiled with previously unmapped wildlife records from SFPUC annual aquatic resource monitoring reports (SFPUC unpublished data). More details about terrestrial species surveys and assessments are presented in Subsection 4.4.1.2, Special-Status Plant and Wildlife Species.

In spring 2008, ETJV biologists and GIS specialists identified study area habitat for California red-legged frog, California tiger salamander, and Alameda whipsnake according to federally designated Critical Habitat primary constituent elements (PCEs) that are essential to the conservation of those species. These habitats are identified and described to refine the discussion of impacts of the CDRP. Details of PCEs are presented in the description of each species later in this section.

In January 2008, ETJV biologists conducted an inventory of oak trees within the project footprint. This mapping was used to refine the vegetation map prepared in 2006 and to support the analysis of oaks impacts and mitigation.

Additional field studies were conducted in 2007, 2008, and 2009 at proposed sites for compensatory mitigation.

4.4.1 SETTING

4.4.1.1 EXISTING CONDITIONS

Subsection 4.4.1.1 Contents

Habitat Types in the Primary Study Area

Terrestrial Habitat

Grassland

Upland Woodland

Scrub

Riparian Forest

Aquatic Habitats

Calaveras Reservoir

Riverine

Wetland

Other Land Cover Types

Disturbed and Developed

Rock Outcrop

Habitat Types in the Extended Study Area

Sensitive Habitats

In the last half of the 19th century, Spring Valley Water Works, the predecessor of the SFPUC, began purchasing the watershed lands that are now owned and managed by the SFPUC. They eventually owned 36,000 acres of the Alameda Creek watershed, including the study area. The acquisition of the watershed lands resulted in their being protected from most human activities. To protect water quality, public access has been limited to recreational hiking and similar activities on portions of SFPUC property and is prohibited near the reservoir, and the SFPUC has carefully regulated all uses on its lands. Watershed and cattle grazing have been the primary uses of the lands for over 80 years; this has had the effect of preserving large areas in a relatively undisturbed state.

The EBRPD owns a substantial amount of land adjacent to the SFPUC property and also leases land from the SFPUC (see Figure 4.3.2, Grazing Use of SFPUC Lands, in Section 4.3, Land Use, Agricultural Resources, and Recreation). The EBRPD manages this land for resource conservation, public access, and recreation.

Climatically, the study area is located in a region that is characterized by conditions that are intermediate between the marine, moderate Mediterranean climate conditions of the Bay Area and the greater seasonality of the interior Central Valley. Temperatures vary widely based on elevation and topography but can range from over 100 degrees Fahrenheit (38+ degrees Celsius) in the summer to below freezing in the winter. Elevations in the study area range from 230 feet to 1,200 feet. Precipitation in the Alameda Creek watershed occurs seasonally, with most of the rainfall between October and April. Although the annual total precipitation in the watershed

varies widely from year to year, average annual precipitation ranges from approximately 10 to 30 inches, depending upon elevation and aspect (see Section 4.6, Hydrology, for more detail). Thus, the Alameda Creek watershed is dominated by species that have adapted to relatively low rainfall and prolonged periods of drought (Jones & Stokes 2006). The primary hydrologic sources for the study area include direct precipitation and surface runoff from precipitation as well as seasonal and perennial creeks. In some areas, mostly on grassland hillsides, the primary hydrologic source appears to be groundwater seepage which, supplemented by surface runoff from adjacent areas, produces surface flows within topographic drainages.

Soil types within the study area range from deep, permeable loams on flat to moderate slopes to rocky, shallow soils with low permeability on steeper slopes. Soils in the study area are formed from alluvium, weathered sandstone, mudstone, and shale or bedrock including serpentine formations (see Section 4.8, Geology, Soils, and Seismicity, for more detail).

Habitat Types in the Primary Study Area

Vegetation communities were mapped by May and Associates in spring 2006 (ETJV 2006a). Vegetation communities were first mapped using aerial photographic interpretation to create coarse vegetation polygons on paper maps (at a scale of 1 inch equals 300 feet), then later verified and refined based on field observations. The minimum mapping unit was 1/4 acre (approximately 11,000 square feet). For consistency, vegetation community nomenclature followed nomenclature developed for the draft AWHCP, which includes both vegetated and unvegetated land. Two additional vegetation communities, “Disturbed” and “Coyote Brush Scrub,” were added by May and Associates’ biologists to more accurately describe vegetation community types observed in the CDRP study area. EDAW biologists made minor additions to May and Associates’ vegetation map to accommodate adjustments to the project design, and refined mapping of oak woodland habitats within the project footprint based on additional oak tree mapping conducted by May and Associates (ETJV 2008).

Vegetation within the Alameda Creek corridor is qualitatively described based on land cover mapping conducted for the draft AWHCP (Jones & Stokes 2006). For areas not on SFPUC land, the California Department of Forestry and Fire Protection (CDF) Land Cover Mapping & Monitoring Program data (CDF 2005) were used. Table 4.4.1 lists the habitat types for the study area. Regional land cover types are shown in Figure 4.4.2, Regional Land Cover.

Terrestrial Habitat

Vegetation in the study area is dominated by non-native grassland. The study area also supports upland woodland (e.g., oak woodlands, oak savannah, mixed evergreen forest), scrub communities, and riparian forest. Habitats in the study area are briefly described below.

Table 4.4.1: Habitat Types and Extent in the Study Area

General Habitat Type	Vegetation Community or Creek Name	Acres or Channel Length ¹	General Habitat Type Acres or Channel Length ¹
Terrestrial Habitats			
Grassland	Non-Native Grassland Valley Needlegrass Grassland Serpentine Bunchgrass Grassland	788 acres 2 acres 73 acres	863 acres
Upland Woodland	Blue Oak Woodland Valley Oak Woodland ² Oak Savannah Mixed Evergreen Forest/Oak Woodland Serpentine Foothill Pine - Chaparral Woodland	17 acres 17 acres 3 acres 287 acres 3 acres	327 acres
Scrub	Coyote Brush Scrub ³ Diablan Sage Scrub	29 acres 50 acres	79 acres
Riparian Forest	Central Coast Live Oak Riparian Forest Coast Live Oak Riparian Forest Sycamore Alluvial Woodland Willow Riparian Forest	8 acres 22 acres 5 acres 3 acres	38 acres
Aquatic Habitats			
Calaveras Reservoir	Open water	1,012 acres	1,012 acres
Riverine	Alameda Creek Calaveras Creek Arroyo Hondo	61,550 feet (11.7 miles) 4,047 feet (0.8 mile) 9,421 feet (1.8 miles)	75,018 feet (14.3 miles)
Wetland	Freshwater Marsh Wetland Seep Wetland Seasonal wetland	1 acres 3 acres 30 acres	34 acres
Other Land Cover			
Disturbed ⁴	Unvegetated	94 acres	94 acres
Developed ⁵	Unvegetated or Landscaped	35 acres	35 acres
Rock Outcrop	Unvegetated	15 acres	15 acres

Notes:

¹ Acreages of terrestrial habitats are based on the results of surveys conducted in the study area by May and Associates (ETJV 2006a, 2006b), which used the draft *Alameda Watershed Habitat Conservation Plan* (Jones & Stokes 2006) land cover classification system. Channel lengths are presented for the entire study area. Acreage values are rounded to the nearest whole number.

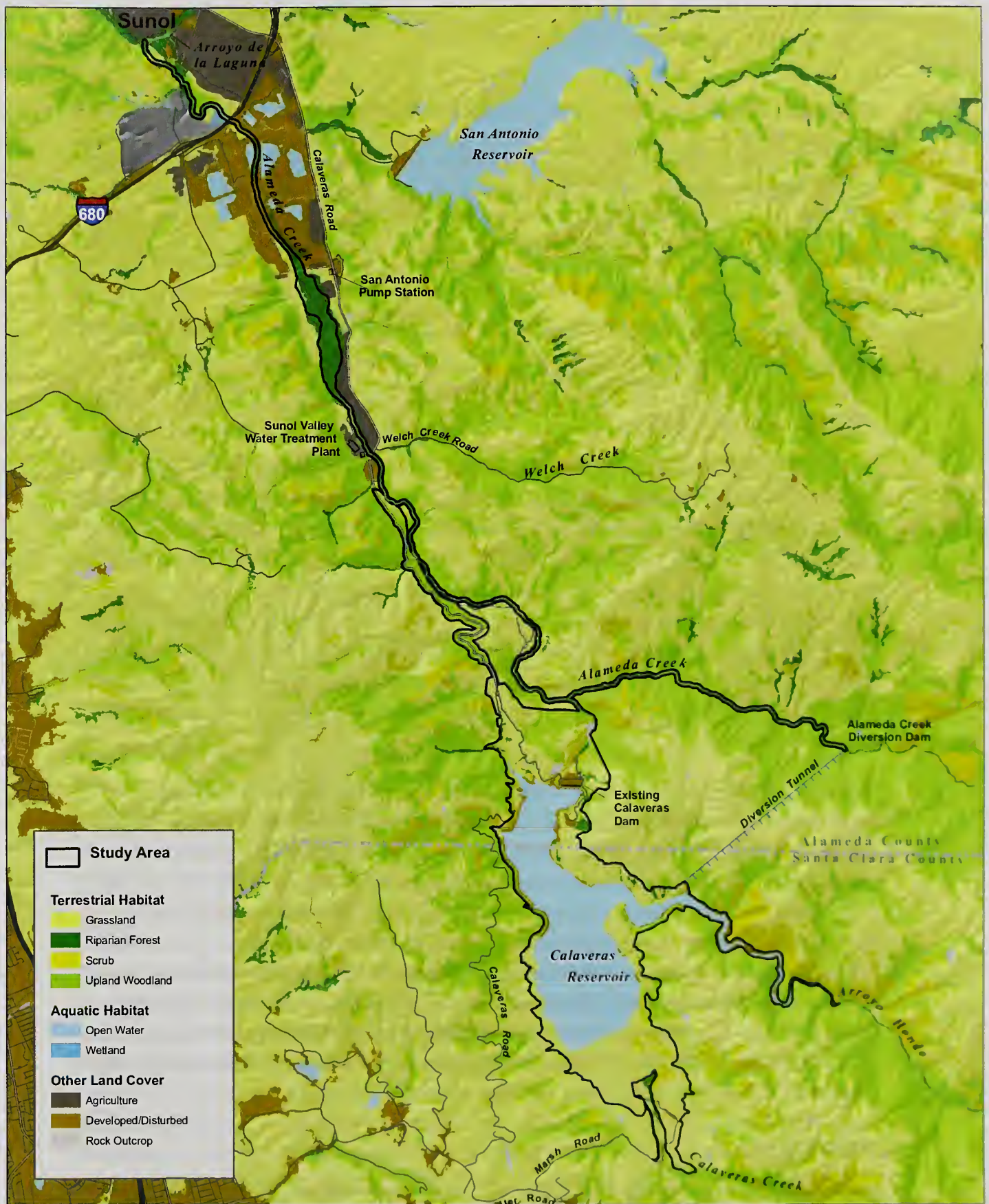
² Valley Oak Woodland is frequently considered a riparian plant community; however, within the study area the majority of this community is found in uplands and does not function as riparian habitat.

³ Coyote Brush Scrub was not described in the draft *Alameda Watershed Habitat Conservation Plan* (Jones & Stokes 2006) but is used here to distinguish between two distinct scrub vegetation types in the study area.

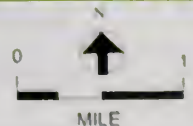
⁴ Disturbed is not described as a land cover in the draft *Alameda Watershed Habitat Conservation Plan* (Jones & Stokes 2006); however, it is used here to describe some portions of the area around Calaveras Reservoir that were inundated from 1925 to 2001 but are exposed at the current reservoir water level.

⁵ Includes developed non-native grassland on the dam face.

Source: ETJV 2006a, pp. 25–34



SOURCE: ETJV 2006b; CDF 2005; Jones and Stokes 2006.



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.4.2: REGIONAL LAND COVER

Grassland

Grassland, which is the most abundant habitat type in the study area, is composed of three plant communities: non-native grassland, valley needlegrass grassland, and serpentine bunchgrass grassland. These grasslands contain mostly introduced, and often invasive, grasses and forbs, with smaller stands of native grasses. Native grassland occurs almost exclusively on serpentine soils.

Grasslands occur on flat or gently sloped terrain and on moderate to steep south-facing hillsides surrounding the reservoir in the study area. Much of the grassland in the study area shows signs of moderate grazing (ETJV 2006a, p. 21), which influences plant diversity and abundance and reduces the vegetation height.

Serpentine grassland occurs on soils derived from serpentinite and generally has lower overall vegetation cover and lower cover of non-native species than valley needlegrass grassland (Jones & Stokes 2006, p. 3-20). Serpentine soils are typically nutrient poor and contain high levels of various metals, including heavy metals. These conditions favor the growth of endemic plants and limit competition by non-natives, often resulting in plant communities that contain rare plants and invertebrate fauna specializing on those plants. In the study area, serpentine grassland typically lacks perennial bunch grasses but contains other native grass species. May and Associates mapped 73 acres of serpentine grasslands in two large stands, one northwest of the dam and the other on the northeastern reservoir shore, and in one small (about 1/4-acre) stand on the north shore of the reservoir.

In general, annual grasslands support lower wildlife diversity than woodland and shrub dominated habitats do but are invaluable to a number of grassland-dependent species (Mayer and Laudenslayer 1988, p. 118). A great diversity and abundance of insects rely on grasslands. Reptiles found in annual grasslands include western fence lizard (*Sceloporus occidentalis*) and common gopher snake (*Thamnophis sirtalis*). Birds that are common in this habitat include western meadowlark (*Sturnella neglecta*) and savannah sparrow (*Passerculus sandwichensis*). Annual grassland also provides important foraging habitat for turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), and red-tailed hawk (*Buteo jamaicensis*). Mammals known to use this habitat include California ground squirrel (*Spermophilus beecheyi*), black-tailed jackrabbit (*Lepus californicus*), and Botta's pocket gopher (*Thomomys bottae*).

Upland Woodland

Upland woodland communities vary significantly in the study area, ranging from open, gently sloped oak woodland with a grassland understory to broad-leaved evergreen forests with an extremely dense shrub understory on steep slopes. The most common upland woodland type in

the study area is mixed evergreen forest/oak woodland, which contains a mixture of co-dominant oaks (*Quercus* spp.), California bay (*Umbellularia californica*), madrone (*Arbutus menziesii*), and California buckeye (*Aesculus californica*). Less abundant communities include blue oak and valley oak woodlands, oak savannah, and serpentine foothill pine-chaparral woodland. Although mostly undisturbed directly by human activities, upland woodlands in the study area are used for grazing, which may reduce survival of oak seedlings, and show evidence of feral pig (*Sus scrofa*) use. Feral pigs, which are abundant in the study area, root through the understory, destroying vegetation (Jones & Stokes 2006, p. 3-39).

A January 2008 oak inventory (ETJV 2008) conducted within the project footprint documented oak trees of four species: coast live oak, blue oak, black oak, and valley oak. In general, oak trees and other native trees observed were in good to very good condition, with substantial oak regeneration (as indicated by presence of numerous oak seedlings and young trees under 8 inches in diameter at breast height [dbh]) observed throughout the study area. Almost all of these oaks are included within oak woodland acreage mapped for the project. Twenty-nine oak trees with dbh 6 inches or greater were mapped outside of the oak woodlands.

Oak-dominated habitats support a wide variety of wildlife species (Mayer and Laudenslayer 1988, pp. 72–79). This rich fauna largely results from acorn production and the availability of cavities for breeding and cover in large oak trees. In fact, the presence of at least some oaks in any habitat type increases wildlife abundance (CalPIF 2002, p. 8). Typical wildlife that use this habitat in the study area include California slender salamander (*Batrachoseps attenuatus*), western rattlesnake (*Crotalus viridis*), wild turkey (*Meleagris gallopavo*), red-tailed hawk, American kestrel, acorn woodpecker (*Melanerpes formicivorus*), California quail (*Callipepla californica*), western bluebird (*Sialia mexicana*), oak titmouse (*Baeolophus inornatus*), spotted towhee (*Pipilo maculatus*), western gray squirrel (*Sciurus griseus*), and black-tailed deer (*Odocoileus hemionus*).

Scrub

The study area includes relatively small amounts of scrub habitat, which is more abundant regionally than in the study area (see Figure 4.4.2). Scrub habitat is characterized by low- to medium-height, drought-tolerant shrubs. Plant species vary greatly with soil moisture availability, disturbance, and fire, and, to a lesser degree, with slope aspect and substrate. Understory vegetation cover is generally sparse where the shrub canopy is dense. In the study area, scrub habitat is composed of Diablan sage scrub (a subunit of northern coastal scrub or coastal sage scrub) and coyote brush scrub. Areas mapped as coyote brush scrub are found at low elevation areas while Diablan sage scrub is typically found along ridges and upper hill slopes. Diablan sage scrub is most common on thin soils on steep slopes north of the dam although it is found in small stands elsewhere.

Scrub habitat generally has lower wildlife diversity than most forest and woodland habitats (Mayer and Laudenslayer 1988, pp. 104–107). However, scrub does provide habitat for many wildlife species, including some that are considered rare elsewhere. Common reptiles found in chaparral include western rattlesnake, California kingsnake (*Lampropeltis getula californiae*), western fence lizard, and western whiptail (*Cnemidophorus tigris*). Common birds in scrub habitat include California thrasher (*Toxostoma redivivum*), Bewick's wren (*Thryomanes bewickii*), California towhee (*Pipilo crissalis*), and California quail. Mammals commonly associated with scrub include gray fox (*Urocyon cinereoargenteus*) and black-tailed deer (*Odocoileus hemionus*).

Coyote brush scrub consists of pure stands of coyote brush (*Baccharis pilularis*), which occurs almost entirely south of the reservoir on land that was submerged before the Division of Safety of Dams (DSOD) limitation on reservoir storage capacity. Within the study area, coyote brush scrub areas are characterized by an “understory” of non-native grasses and seasonal wetland plants. During the unusually heavy rains in March 2006, many of these areas became flooded, causing most of the coyote brush population to be in poor condition as a result of prolonged inundation (ETJV 2006a, p. 26). Monotypic stands of coyote brush scrub provide poor wildlife habitat.

Riparian Forest

Riparian forest habitat is found along streams in small portions of the study area and is composed of five plant communities: central coast live oak riparian forest, coast live oak riparian forest, sycamore alluvial woodland, willow riparian forest/scrub, and white alder riparian forest (which, in the study area, occurs only on Alameda Creek). Riparian forest mostly occurs along the Alameda Creek corridor in the study area. It also occurs in narrow bands on the margins of intermittent and perennial streams and around the reservoir's former full-pool (Elevation 756 feet) shoreline.

Coast live oak riparian forest and central coast live oak riparian forest are the most common riparian habitat types in the study area. Coast live oak riparian forest is found in isolated ephemeral stream drainages surrounded by scrub or grassland. It is dominated by coast live oaks (*Quercus agrifolia*) with an understory of grassland species. Shrubs, including coyote brush, poison oak, and blue elderberry (*Sambucus mexicanus*), are scattered in the understory along ephemeral drainages. Central coast live oak riparian forest is distinguished from coast live oak riparian forest by its species composition and ecotone. This community occurs in moister sites than coast live oak forest and is found in canyon bottoms and floodplains along perennial and intermittent streams (Jones & Stokes 2006, p. 3-32). It is dominated by a single tree species, coast live oak, and has a denser understory than coast live oak riparian forest. Other tree species identified in both communities include big-leaf maple (*Acer macrophyllum*), California buckeye, western sycamore (*Platanus racemosa*), and willow (*Salix* sp.). Understory species included poison oak, coyote brush, and annual grasses.

Sycamore alluvial woodland is uncommon in the study area, typically occupying deep alluvial terraces on low-gradient streams. The largest stand in the study area is on Alameda Creek, downstream of Calaveras Creek, near the Sunol aggregate quarries. Another stand on Alameda Creek occurs upstream of the confluence with Calaveras Creek. Two small stands were mapped by May and Associates (ETJV 2006a): one occurs in a small valley that drains into the north end of Calaveras Reservoir, and the other occurs on a hillside north of the Arroyo Hondo arm of the reservoir. Alluvial substrates contain thin, nutrient-poor soils and are highly permeable. During the dry season, surface water infiltrates rapidly, leaving the streambed dry although deep subsurface flows may be maintained.

Willow riparian forest/scrub occurs in and along the margins of active channels on intermittent and perennial streams. Willow riparian forest was mapped in only one location by May and Associates (ETJV 2006a), a dense, mature 3-acre stand at the base of the Calaveras Dam. Willow riparian forest/scrub increases the value of aquatic habitats to fish, amphibians, and invertebrates by providing shade that cools and stabilizes stream temperatures.

White alder riparian forest occurs along the margins of active channels along Alameda Creek, Calaveras Creek, and Arroyo Hondo.

Evidence of cattle and feral pigs was often observed in riparian habitats in the study area. Habitat degradation caused by cattle and pigs, which was documented during 2006 fields surveys by May and Associates and EDAW, included trampled vegetation, compacted soils, mud wallows in areas that could support special-status species, and degraded water quality in ponds and streams.

Riparian forests are particularly valuable in their function as an interface between aquatic and terrestrial communities. Riparian zones provide nutrients, shade, and bank stabilization for aquatic systems, as well as nesting and foraging habitat, migration corridors, and refuges for wildlife. Common mammals found in this habitat type include raccoon (*Procyon lotor*), gray fox, striped skunk (*Mephitis mephitis*), and dusky-footed woodrat (*Neotoma fuscipes*). Numerous birds are also found in this habitat, such as Wilson's warbler (*Wilsonia pusilla*), yellow warbler (*Dendroica petechia*), red-shouldered hawk (*Buteo lineatus*), song sparrow (*Melospiza melodia*), and black-headed grosbeak (*Pheucticus melanocephalus*).

Aquatic Habitats

Calaveras Reservoir

At the current restricted reservoir elevation, Calaveras Reservoir provides over 1,000 acres of aquatic habitat. Calaveras Reservoir receives runoff from the contributing watershed, primarily Arroyo Hondo and Calaveras Creeks, and diversion from Alameda Creek through the ACDD and tunnel. Water losses from the reservoir include withdrawals for the Sunol Valley Water

Treatment Plant (SVWTP), spills and other beneficial releases to Calaveras Creek for maintaining environmental flows, and a minor amount of evaporation, infiltration, and seepage. Withdrawals for water supply are greatest from fall through spring and are minimized beginning at the end of the rainy season at the end of spring or early summer. Typically, reservoir storage levels reflect the seasonal pattern of precipitation and runoff, with storage levels increasing between November and March and decreasing between April and October. Much of the historic reservoir edge which is now exposed does not support vegetation. However, in the southern portion of the reservoir, where the topography is less steep and the reservoir is shallower, grasslands, seasonal wetlands, and coyote brush scrub are present between the current reservoir shoreline and the pre-DSOD restricted reservoir edge.

The reservoir provides both warm-water and cold-water habitat. Bass, sunfish, and catfish constitute the primary warm-water fisheries in Calaveras Reservoir. The reservoir's cold-water species include rainbow trout (*Oncorhynchus mykiss*). Although most of the reservoir is relatively deep, areas around the reservoir edge and the southern portion of the reservoir provide shallow-water habitat for some reptile and amphibian species, such as western pond turtle (*Actinemys [=Clemmys] marmorata*) and bullfrogs (*Rana catesbeiana*).

Riverine

The study area includes three main riverine systems: Alameda Creek, lower Calaveras Creek, and Arroyo Hondo. Aquatic habitat in the study area is briefly described below; please see “Primary Study Area” under “Aquatic Habitats” in Section 4.5, Fisheries and Aquatic Habitat, for greater detail about the riverine environment.

Downstream of the ACDD, Alameda Creek flows north through a wide canyon, and, with the exception of a series of drop-pools associated with an area known as “Little Yosemite,” it is generally a low-gradient creek 30 to 65 feet wide at the ordinary high water mark (OHWM). Riparian vegetation varies from dense cover, fully shading the channel, to sparse, where the creek is completely unshaded. Downstream of the confluence with Calaveras Creek, the volume of flows on Alameda Creek is influenced by releases from Calaveras Dam. The creek contains large, deep pools, overhanging riparian vegetation, and a variety of creek habitats including riffles and runs.

From May through August 2006, SFPUC fisheries biologists surveyed the 2.9-mile reach of Alameda Creek between the ACDD and Little Yosemite to observe spatial and temporal flow patterns during what may be considered “best-case” conditions for native fishes (SFPUC 2007). Total rainfall during the 2006 water year⁴ was above average, especially in late spring, so there

⁴ “Water year” is the 12-month period from October 1 through September 30. Those dates are used in California to establish the typical beginning of the wet period. The water year is designated by the calendar year in which it ends (for example, the year ending September 30, 2006 is called the “2006 water year”).

were no diversions from Alameda Creek to Calaveras Reservoir. The focus of each survey was to document both the reach's connectivity and the total number of miles of wetted channel. The reach was entirely wet on June 22. Sections of creek (10 percent) were documented as beginning to dry out by mid-July, with 23 percent of the reach dry by July 26. Little additional drying occurred through the end of the study in mid-August; by August 17 only 25 percent of the reach was dry. Six wetted pools, primarily root wad enhanced scour pools at the base of large sycamore trees, remained along the dry, disconnected portions of the creek (SFPUC 2007, p. 4). The reaches that stayed wetted were contained in regions where the valley narrows, with the stream channel composed primarily of bedrock, and the reach that dried was located in a wide alluvial valley (SFPUC 2007, p. 7).

The SFPUC also monitored the extent of wetted channel in Alameda Creek between ACDD and Little Yosemite during a below-average precipitation year with continuous diversions at ACDD (SFPUC 2008). In the late spring and summer of 2007, the channel began drying between the May 1 and May 17 surveys. Short disconnected sections dried first in the wide, alluvial lower portion of the reach. As the creek continued to dry over time, a number of wetted riffles and pools remained within the dry, disconnected portions of the creek. Drying continued steadily through late spring and summer. By the last survey on September 10, about 2.1 miles (72 percent) of continuous channel was dry. The remaining wetted section was located on high-gradient, bedrock sections of the reach immediately downstream of the ACDD.

Calaveras Creek from the existing Calaveras Dam to the confluence with Alameda Creek has high- and low-gradient sections where surface water flows almost entirely over bedrock and large boulders. Water seeping through the dam provides a source of very low (about 0.5 to 1 cubic foot per second [cfs]) perennial flows in the creek (CDFG 1997, p. 7; Bookman-Edmondston 1995, p. 1-1). These flows increase dramatically with releases through a 72-inch-diameter cone valve at the dam or by flows over the spillway. No spills over the spillway have occurred since the DSOD restrictions were put into effect in 2001. During the project baseline period, the cone valve has been operated to release water from the reservoir from December 2001 through February 2002 to lower the reservoir level to comply with the DSOS required restricted reservoir level. The cone valve was used two more times during the baseline period (March 2005 through May 2005 and March 2006 through June 2006) to maintain the reservoir within the restricted operating range (maximum pool elevation of 705 feet).

Riparian vegetation along Calaveras Creek downstream of the dam varies from dense, fully shading the channel, to sparse, where the creek is completely unshaded. There is an approximately 600-foot length of 4-foot-wide concrete on the eastern side of the streambed, associated with the Calaveras Pipeline. Several perennial pools with emergent vegetation have formed at undercuts of the concrete.

Arroyo Hondo is a perennial tributary to Calaveras Creek upstream of the dam, flowing through a deep, steep-walled canyon. The stream averages 15 to 30 feet wide at the OHWM, with numerous deep (5- to 10-foot) pools, riffles, and runs. Dominant substrate is cobble and gravels, with areas of larger boulders and some bedrock. Flows in Arroyo Hondo are highly variable with high flows in winter months and extremely low flows in mid- to late summer. In 2006, EDAW biologists documented flows into the reservoir in late October, but in August 2004 CDFG staff documented an approximately 1.5-mile dry zone upstream of the reservoir (CDFG 2005a, p. 4). Riparian cover over the stream is greater farther upstream from the reservoir; there is limited riparian vegetation within the former full-pool elevation of the reservoir (i.e., the study area), which contains mud and silt deposits in areas inundated prior to DSOD restrictions on reservoir capacity.

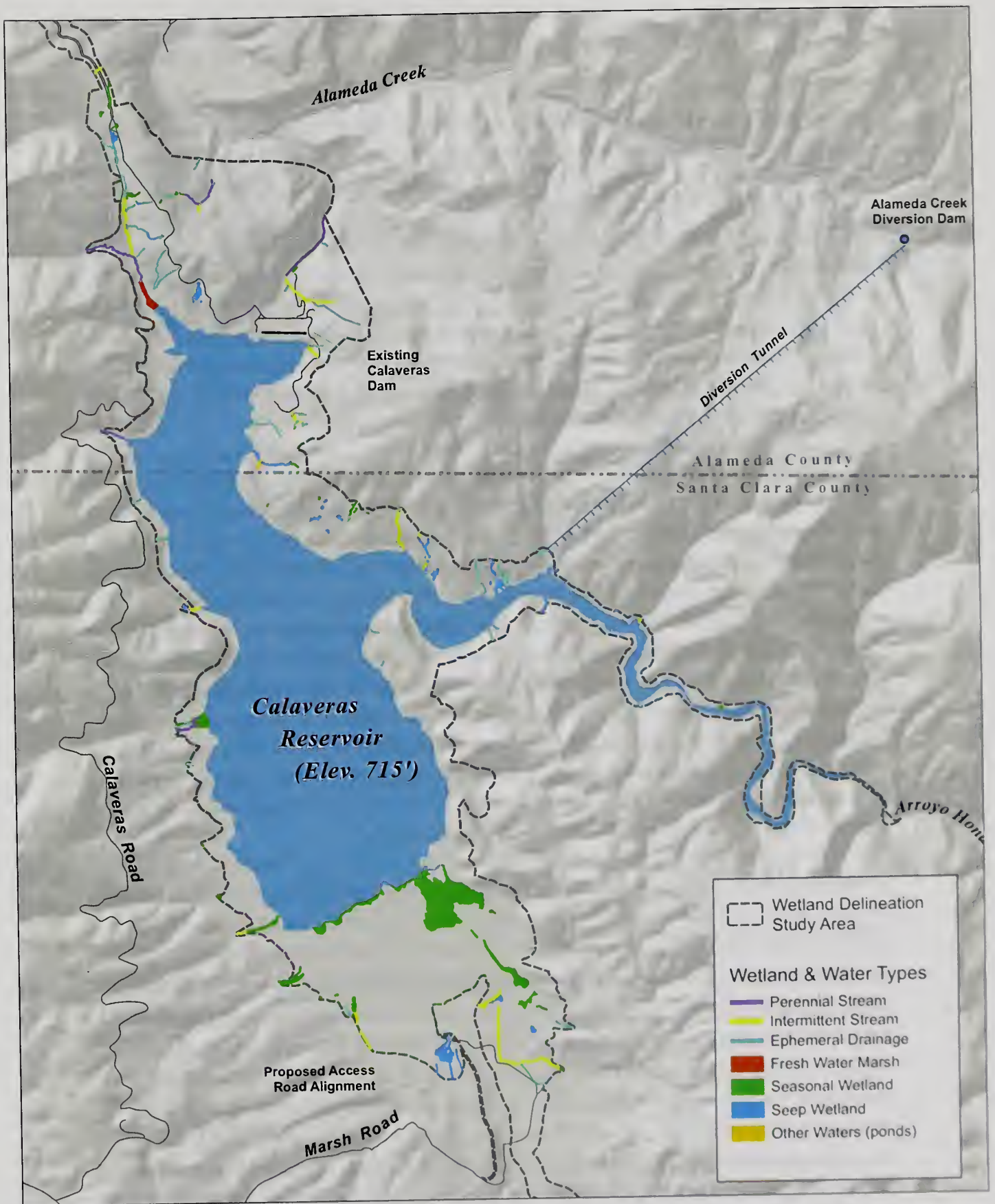
Wetland

Detailed wetland mapping was conducted for a wetland delineation (ETJV 2006b), and verified by the USACE on December 12, 2007. Wetland habitat mapped in the study area by May and Associates is composed of freshwater marsh wetland, seep wetland, and seasonal wetlands. The results of detailed wetland mapping are shown in Figure 4.4.3, Wetlands.

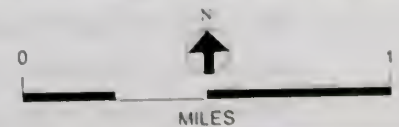
Freshwater marshes generally occur near river mouths or adjacent to lakes and springs and are characterized by a year-round water source. Ecosystem functions include removing nutrients and toxins from surface water, producing vegetative and invertebrate forage and dry-season water for wildlife, and serving as breeding areas for wetland-associated birds, amphibians, and other wildlife. In the study area, freshwater marsh is mapped only in two relatively small locations at the base of two unnamed perennial streams where they flow into Calaveras Reservoir. The locations are subject to fluctuating water levels as the reservoir level rises and falls. Freshwater marsh is dominated by obligate wetland and facultative wetland⁵ plants such as watercress (*Rorippa nasturtium-aquaticum*), curly dock (*Rumex crispus*), willow herb (*Epilobium ciliatum*), and poison hemlock (*Conium maculatum*) (ETJV 2006a). In December 2006 the freshwater marsh at the base of both creeks appeared dry and dominated by desiccated facultative wetland and facultative⁶ species such as cocklebur (*Xanthium* sp.) and umbrella sedge (*Cyperus* sp.).

⁵ Obligate wetland species almost always occur in wetlands under natural conditions. Facultative wetland species usually occur in wetlands but are occasionally found in non-wetlands.

⁶ Facultative species are equally likely to occur in wetlands or non-wetlands.



SOURCE: ETJV 2006b, ETJV 2009.



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FIGURE 4.4.3: WETLANDS

Seep wetlands generally occur in grasslands and meadows as a result of seasonal or perennial groundwater seepage at grade breaks or intersections of different subsurface strata where groundwater tends to rise to the surface (Jones & Stokes 2006, p. 3-39), as opposed to surface ponding from runoff. Seeps occur predominantly in the northeastern portion of the study area, especially in level areas within creeks or drainages; others occur as isolated features on grassland or exposed rocky slopes. In the study area, seeps provide ecosystem functions and services such as sources of water for wildlife for drinking, foraging, and breeding. Surface pooling is often limited to occurring within hoof prints, which provide limited breeding habitat (compared to freshwater marsh) for amphibians and other aquatic organisms. Habitat quality can be degraded by feral pigs, which trample and uproot vegetation. Fluctuating groundwater tables can cause seeps to be wet only for portions of the year.

Seasonal wetlands in the study area occur most frequently in topographic depressions in grassland habitat at the base of slopes and/or along roads. These wetlands are dominated by annual, facultative plants, the most common of which include invasive Italian ryegrass (*Lolium multiflorum*) and Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*). The largest seasonal wetlands are located south of the reservoir within the area inundated by the reservoir prior to DSOD restrictions. The size of seasonal wetlands along the reservoir's margin fluctuates with the rise and fall of the reservoir surface (see Figure 4.6.9, Daily Water Surface Elevations in Calaveras Reservoir (1998–2009), in Section 4.6, Hydrology, for degree of fluctuation). As water is released and the surface elevation is reduced, annual facultative plant species grow in the saturated soils on the receding margin; these areas are inundated as the reservoir fills. These seasonal wetlands provide some water quality improvement during wet periods when water may flow through the vegetation. Other habitat values and functions of seasonal wetlands in the study area are similar to those described for non-native grasslands.

Other Land Cover Types

Disturbed and Developed

Disturbed and developed areas have been highly modified and do not provide conditions that support native vegetative conditions. The disturbed land-cover classification encompasses highly disturbed vegetated areas including much of the area between the current reservoir water level, targeted at a nominal elevation of 705 feet, and the pre-2001 DSOD-restricted water level elevation of 756 feet. This area was seasonally inundated most of the time from 1925 to 2001. Since being temporarily exposed in 2001 after the reservoir was drawn down, it has been invaded by annual non-native vegetation such as sweet fennel (*Foeniculum vulgare*), Mediterranean mustard (*Hirschfeldia incana*), and Italian thistle (*Carduus pycnocephalus*). Soils are extremely thin, if existent at all, in disturbed areas. Developed areas near the reservoir include the spillway, paved roads, a livestock corral, and the SFPUC watershed keeper's residence and landscaping. Developed areas along Alameda Creek include quarries, commercial nurseries, and a golf course.

Rock Outcrop

Rock outcrop areas are unvegetated or sparsely vegetated areas with little to no soil. Several relatively large rock outcrops are found along lower Calaveras Creek and are almost vertical in slope. A few smaller rock outcrops are found at the north end of the reservoir and are more gently sloped.

Habitat Types in the Extended Study Area

Beginning downstream of the Arroyo de la Laguna confluence, Alameda Creek flows approximately 6.5 miles through Niles Canyon to Niles Junction (near the crossing of Highway 238). The stream channel is relatively confined within the steep-walled canyon and, with the exception of Highway 84 and a rail line, there is little development on the narrow floodplain and surrounding hills. There is a relatively well-developed riparian zone throughout Niles Canyon. The reach is a relatively low-gradient perennial stream characterized by large, moderately deep pools, and runs separated by short, shallow riffles. The substrate is highly variable, ranging from sand, gravel, and cobble dominated riffles and glides to cobble-boulder and silt, mud, and sand pools. Alameda Creek through Niles Canyon now serves as a conveyance for imported water supply from the South Bay Aqueduct turnout in Vallecitos Creek, which is tributary to Arroyo de la Laguna just upstream of the Alameda Creek confluence. As a result, summer base flows in Niles Canyon have increased and become less variable, thereby increasing overall water (and pool) temperatures, reducing thermal buffering that historically occurred with subsurface flows. Operation of upstream storage facilities, including Del Valle, San Antonio, and Calaveras Reservoirs, has reduced winter and spring peak flows from historic conditions in this reach of Alameda Creek.

Beginning downstream from the mouth of Niles Canyon, Alameda Creek flows approximately 10 miles across a broad, low-gradient alluvial plain to San Francisco Bay. This reach is highly modified for flood control. Aquatic habitat conditions in this reach of lower Alameda Creek are characterized by low summer flows, high summer water temperature, substrate with a large silt component, extensive stands of emergent vegetation, and tidal mixing with increased salinity in the lower sections near the bay and freshwater flows in the higher lying reaches upstream of the Bay Area Rapid Transit (BART) weir. Some sections may be dry during the summer (Hanson Environmental Inc. 2002).

Sensitive Habitats

For the purposes of this EIR, sensitive habitats are defined as habitats with particularly high ecological values or functions, of limited distribution, or of concern otherwise to local, state, and/or federal resource agencies. Sensitive habitats include those that are of special concern to CDFG (e.g., those identified as having high priority for inventory by the CNDDDB, USFWS, or those that are afforded specific consideration through the California Environmental Quality Act

[CEQA], Section 1602 of the California Fish and Game Code, and/or Section 404 of the Clean Water Act [CWA]).

All wetland and riparian habitats in the study area are considered sensitive. Wetland habitats include freshwater marsh, seeps, and seasonal wetlands. Wetland habitats are discussed previously in this section under “Aquatic Habitats.” Riparian habitats include sycamore alluvial woodland, willow riparian forest, and coast live oak and central coast live oak riparian forests. Two upland habitats, upland oak woodlands and serpentine bunchgrass grassland, are considered sensitive.

4.4.1.2 SPECIAL-STATUS PLANT AND WILDLIFE SPECIES

Subsection 4.4.1.2 Contents

Special-Status Plants in the Primary Study Area

- Diablo Helianthella

- Most Beautiful Jewel-Flower

Special-Status Wildlife in the Primary Study Area

- Callippe Silverspot Butterfly

- California Red-Legged Frog

 - Aquatic Breeding Habitat

 - Non-Breeding Aquatic Habitat

 - Upland Habitat

 - Dispersal Habitat

- California Tiger Salamander

 - Aquatic and Breeding Habitat

 - Upland Habitat

 - Dispersal Habitat

- Foothill Yellow-Legged Frog

- Alameda Whipsnake

 - Scrub/Shrub Communities with a Mosaic of Open and Closed Canopy

 - Woodland or Annual Grassland Plant Communities Contiguous to Scrub/Shrub

 - Lands Containing Rock Outcrops, Talus, and Small Mammal Burrows Within or Adjacent to PCEs 1 and/or 2

- Bald Eagle

- Berkeley Kangaroo Rat

- Western Pond Turtle

- Nesting Raptors

 - Cliff-Nesting Raptors

 - Ground-Nesting Raptors

- Upland Species of Concern

 - Loggerhead Shrike

 - Grasshopper Sparrow

 - Tricolored Blackbird

Subsection 4.4.1.2 Contents

continued

American Badger
Townsend's Big-Eared Bat
Pallid Bat
Western Mastiff Bat

Special-Status Plant and Wildlife Species in the Extended Study Area

Special-status plant and wildlife species are species that are legally protected under the Federal Endangered Species Act (FESA) and/or California Endangered Species Act (CESA) or other regulations, or are considered by the scientific community to be sufficiently rare to qualify for such listing. Special-status species as defined in this section include plants and animals in the following categories:

- Species listed or proposed for listing as threatened or endangered under FESA or CESA;
- Species considered as candidates for listing as threatened or endangered under FESA or CESA;
- Species identified by CDFG as California Species of Special Concern;
- Animals fully protected in California under the California Fish and Game Code;
- Bald and golden eagles protected by the federal Bald and Golden Eagle Protection Act;
- Species that meet the definitions of rare or endangered species under Section 15380 of CEQA; and
- Plants on the CNPS List 1B (plants considered by CNPS to be rare, threatened, or endangered in California and elsewhere) or List 2 (plants considered rare, threatened, or endangered in California but more common elsewhere).

Lists of special-status plant and wildlife species considered for evaluation in this document were generated by consulting the sources listed in "Literature and Database Review" earlier in this section. The full list of plants and animals considered is presented in Appendix C.1, Special-Status Plant and Animal Species Evaluated in the Calaveras Dam Replacement Project EIR. Species on this list were eliminated from further consideration if the primary study area is outside the species' range or does not contain suitable habitat.

Special-Status Plants in the Primary Study Area

May and Associates (ETJV 2006a) evaluated 57 special-status plants to determine their potential for occurrence in the study area. May and Associates' biologists conducted surveys during the spring and summer of 2006 for special-status plants considered to have the potential to occur in the study area. Survey timing was based on the blooming period for targeted species and then adjusted to local conditions (e.g., temperature, rainfall, observed local blooming patterns, etc.). The botanical survey protocol was based on the CDFG's "Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities" (CDFG 2000).

Several special-status plants included in the evaluation by May and Associates were eliminated from consideration in this EIR because the study area was determined to be outside the species' range or because suitable habitat was determined to be absent. Forty-four special-status plants that are known to occur in the vicinity of the study area, or that could occur because suitable habitat is present, are included in Appendix C.1. Two of these plants, Diablo helianthella (*Helianthella castanea*) and most beautiful jewel-flower (*Streptanthus albidus* ssp. *peramoenus*), were observed in the study area during field surveys conducted in 2006.

Diablo Helianthella

Diablo helianthella is a perennial herb that blooms from March through June and occurs in upland forest, woodland, scrub, and grassland habitats. It is typically found in filtered sunlight areas beneath open-canopied woodlands, at elevations ranging from 80 to 3,800 feet in the northern San Francisco Bay Area. Diablo helianthella is a CNPS List 1B plant (rare, threatened, or endangered in California or elsewhere). Diablo helianthella was found in the study area during late spring botanical surveys (ETJV 2006a). Four small occurrences (population sizes ranged from 1 to 30 plants) were found in the northern portion of the study area, in an understory of mixed oak and blue oak woodland (see Figure 4.4.4, Rare Plant Occurrences).

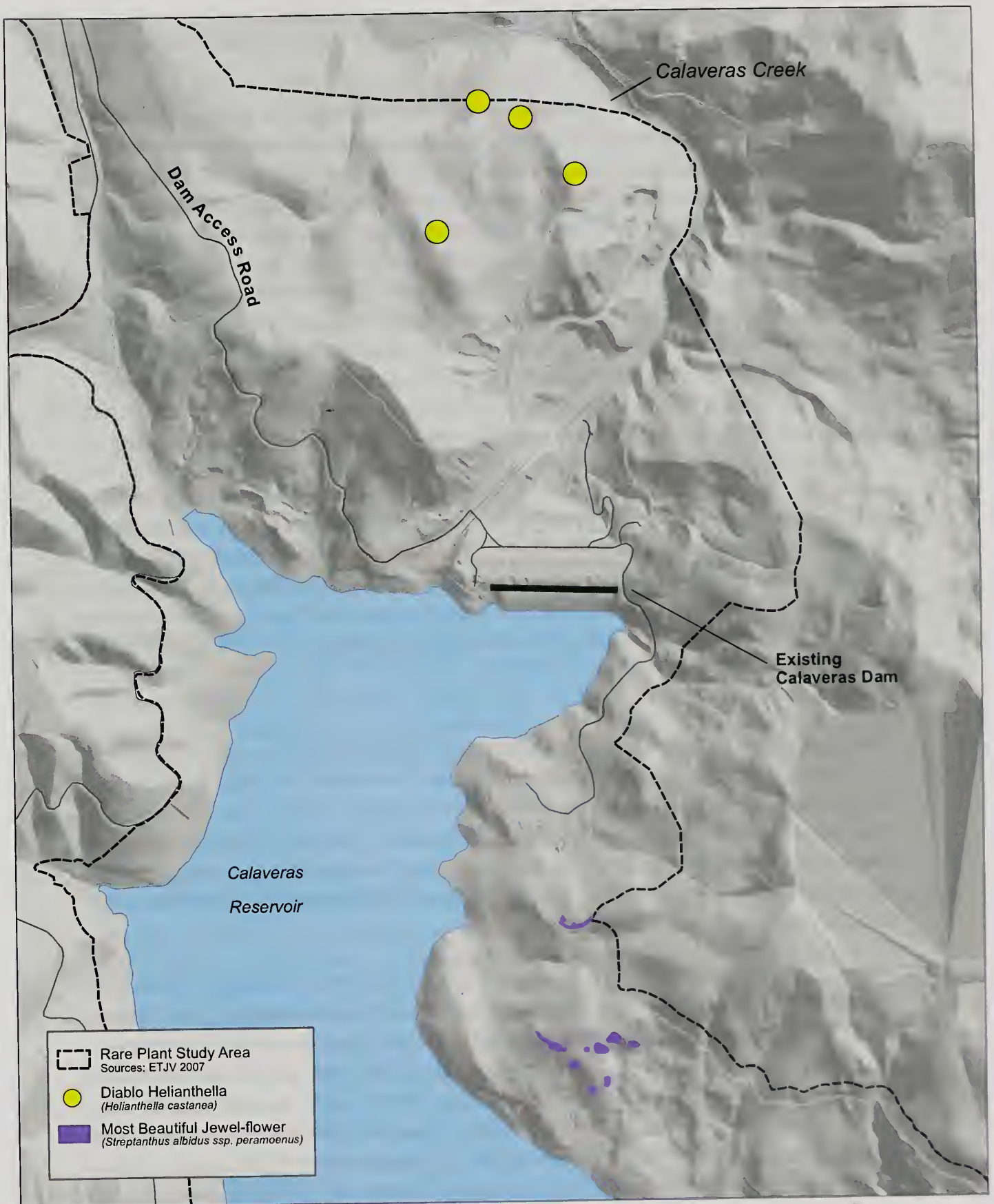
Most Beautiful Jewel-Flower

Most beautiful jewel-flower is an annual herb that blooms from April through June on mostly serpentine outcrops in chaparral, valley, foothill grassland, and cismontane woodland habitats. It is found at elevations of 400 to 2,400 feet in the eastern San Francisco Bay Area and central Outer South Coast Ranges. Most beautiful jewel-flower is a CNPS List 1B plant. This species was found in the study area during late spring 2006 botanical surveys (ETJV 2006a). Eleven small occurrences (population sizes ranged from 5 to 200 plants) were found on rock outcrops or road cuts in serpentine grassland on the northeast reservoir shore (see Figure 4.4.4).

Special-Status Wildlife in the Primary Study Area

A total of 30 special-status wildlife species are known to occur or could occur in the study area (Appendix C.1). Species listed under the state and/or federal Endangered Species Acts⁷ include Callippe silverspot butterfly, California tiger salamander, California red-legged frog, Alameda whipsnake, and bald eagle. Additional information on these listed special-status wildlife species is presented below.

⁷ Includes Endangered, Threatened, Proposed, and Candidate species.



SOURCE: ETJV 2006a.

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FIGURE 4.4.4: RARE PLANT OCCURRENCES

Special-status species not listed under the state and/or federal Endangered Species Acts that are expected to occur or could occur in the study area include foothill yellow-legged frog (*Rana boylei*), western pond turtle, silvery legless lizard (*Anniella pulchra pulchra*), California horned lizard (*Phrynosoma coronatum frontale*), osprey (*Pandion haliaetus*), white-tailed kite (*Elanus leucurus*), great blue heron (*Ardea herodias*), northern harrier (*Circus cyaneus*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), American peregrine falcon (*Falco peregrinus anatum*), prairie falcon (*Falco mexicanus*), burrowing owl (*Athene cunicularia*), long-eared owl (*Asio otus*), loggerhead shrike (*Lanius ludovicianus*), grasshopper sparrow (*Ammodramus savannarum*), tricolored blackbird (*Agelaius tricolor*), Townsend's big-eared bat (*Corynorhinus townsendii townsendii*), pallid bat (*Antrozous pallidus*), western mastiff bat (*Eumops perotis californicus*), Berkeley kangaroo rat (*Dipodomys heermanni berkeleyensis*), and American badger (*Taxidea taxus*) (Appendix C.1). Species not expected to occur are not discussed in this EIR (Appendix C.1).

CDFG has commented that the study area has been identified as especially important to foothill yellow-legged frog and potentially to Berkeley kangaroo rat (CDFG 2005a). Information on these two species is presented below. The remaining special-status wildlife species not listed under the state and/or federal Endangered Species Acts are analyzed later in this section based on their habitat relationships and information presented in Appendix C.1.

Callippe Silverspot Butterfly

Callippe silverspot butterfly (*Speyeria callippe callippe*) is federally listed as endangered. Only this subspecies is included in the listing; however, its common name is used to refer to both the species (*Speyeria callippe*) and the subspecies (*Speyeria callippe callippe*). The callippe silverspot subspecies (*Speyeria callippe callippe*) is endemic to the San Francisco Bay Area and is one of 16 subspecies of *Speyeria callippe*, which ranges from the Rocky Mountains to the West Coast (Entomological Consulting Services 2004b, p. 4). The discussion below refers just to the listed subspecies.

The callippe silverspot butterfly is known from 14 historical populations in the San Francisco Bay region. The historical range of the callippe silverspot butterfly includes the inner Coast Ranges on the eastern shore of San Francisco Bay from northwestern Contra Costa County south to the Castro Valley area in Alameda County. On the west side of the bay, it ranged from San Francisco south to the vicinity of La Honda in San Mateo County. At the time of the listing, the only extant colonies were known from private land on San Bruno Mountain in San Mateo County and a city park in Alameda County (USFWS 1997, p. 64307). Additional populations of callippe silverspot butterfly occur in the Sky Valley-Lake Herman area of southern Solano County, at Sears Point in Sonoma County, and in the area between Dublin, Pleasanton, and Sunol in Alameda County (Entomological Consulting Services 2004b, p. 5).

The primary cause of the decline of the callippe silverspot butterfly is the loss of habitat from human activities. Destruction and alteration of habitat due to off-road vehicle use, unsuitable levels of livestock grazing, and invasive exotic vegetation are leading causes of population reduction. The food plants of the larvae and the adult nectar sources can also be crushed by off-road vehicles and trampled by horses and hikers (USFWS 2006b, p. 1).

The callippe silverspot occurs in grasslands where its sole larval food plant, johnny jump-up (*Viola pedunculata*), grows. This butterfly prefers hilly terrain with a mixture of topographic relief. Adults tend to congregate on prominent hilltops where they search for potential mates. Adults live for an average of 5–7 days. The flight season is usually from about mid-May through early July but may vary depending upon seasonal weather conditions. Because of the length of the flight season, adults visit several different food plant species to obtain nectar as these plants flower during different periods. When available, the favored nectar plants include mints (especially *Monardella* sp.), thistles (such as *Silybum* sp. and *Cirsium* sp.), and buckeye. Flowers of other species may also be visited depending on their availability at a particular location. Areas where the larval and adult food plants grow do not always coincide with the areas where mate selection and other behaviors occur (Entomological Consulting Services 2004b, p. 5).

The females lay their eggs on the dry remains of the larvae host plant or on the surrounding debris. Within about 1 week of hatching, the caterpillars wander a short distance and spin a silk pad where they suspend growth and limit physical activity for the summer and winter. In spring the larvae resume growing and emerge as adults for the flight period (USFWS 1997, p. 64307). As a result, habitat containing larval host plants could support either eggs or larvae essentially throughout the year.

Surveys for callippe silverspot were conducted in 2004 by Dr. Richard Arnold and Dr. Robert Jensen throughout the approximately 36,000-acre Alameda Creek watershed in support of the draft AWHCP (Entomological Consulting Services 2004b, p. 5; 2005, p. 2). These surveys specifically targeted a 3,916-acre study area surrounding Calaveras Dam in support of the CDRP (Entomological Consulting Services 2004a, p. 5).

A total of 1,301 individual adult silverspots were closely observed between May 15 and June 30, 2004 in the grasslands and woodlands east and south of San Antonio Reservoir; feeding on nectar of buckeyes, thistles, and mint in the Sunol Wilderness Regional Preserve (Sunol Wilderness); and feeding on buckeyes north of Calaveras Dam and in the grasslands and woodland areas east of Calaveras Dam (Entomological Consulting Services 2004b, pp. 7-8). The majority (78 percent) of the individuals were observed in the Calaveras Dam area (Entomological Consulting Services 2004b, p. 8).

Based on close field observation of wing and maculation (i.e., spotting pattern) colors, silverspots observed in the field were classified by subspecies. Arnold concluded that 32 percent of the

adults he observed appeared characteristic of *Speyeria callippe callippe*, 26 percent were typical of *S. callippe comstocki*, and 42 percent exhibited traits that were intermediate between typical *S. callippe callippe* and *S. callippe comstocki* (Entomological Consulting Services 2004b, p. 10). However, he recommended that, “for the purposes of future project planning and habitat management,...[SFPUC should] treat the Alameda watershed populations of near *S. callippe callippe* as though it is the endangered silverspot butterfly” (Entomological Consulting Services 2004b, p. 10). He cited a similar situation at the City of Pleasanton’s Happy Valley Golf Course for which USFWS treated a population of near *S. callippe callippe* as the endangered insect (Entomological Consulting Services 2004b, p. 10).

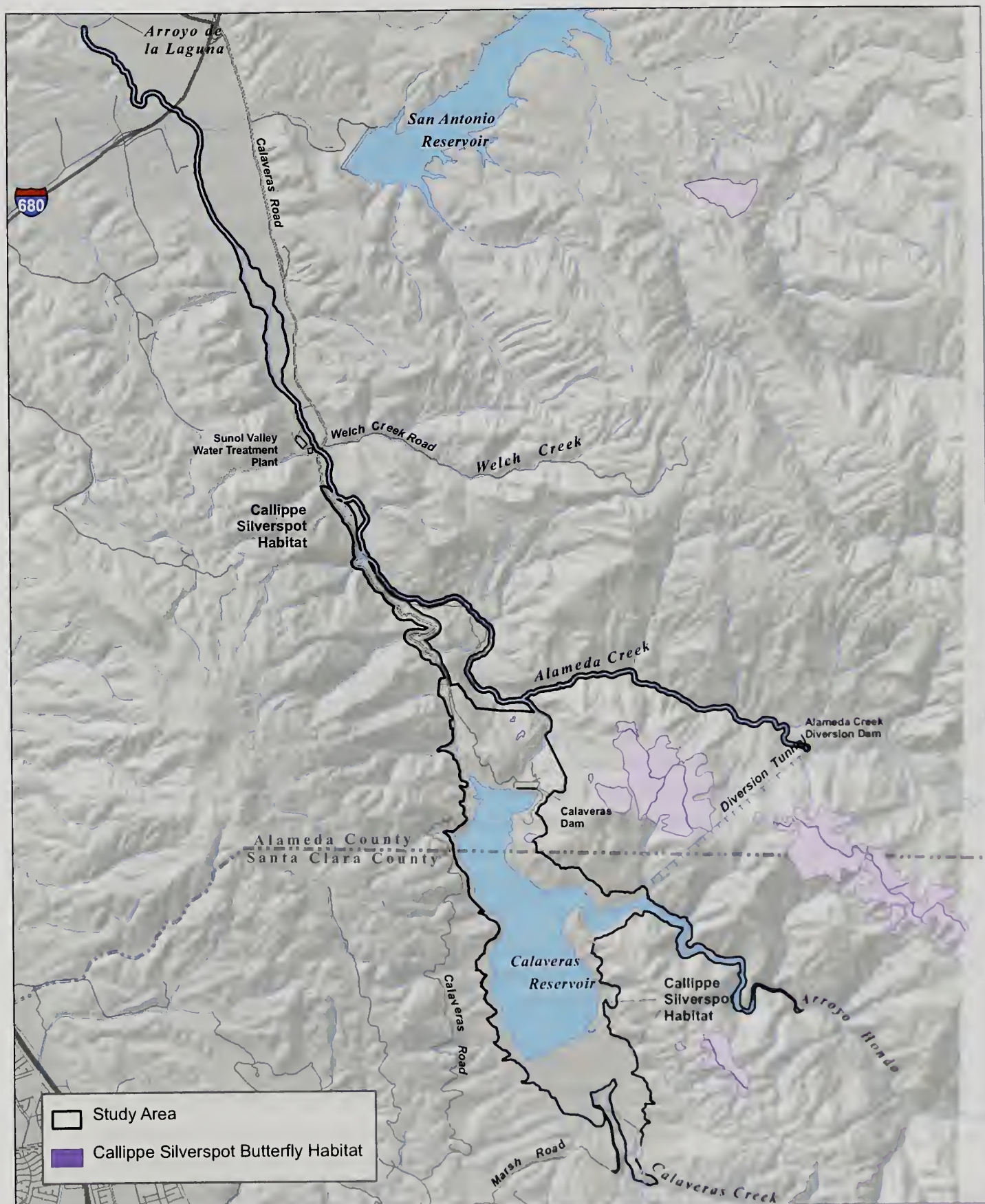
Habitat for callippe silverspot was mapped in 2004 and focused on the area proposed to be covered by the draft AWHCP and a large area around Calaveras Reservoir because the study area for the CDRP had not been defined yet (Entomological Consulting Services 2004b, p. 14). Because callippe silverspot spends most of its life cycle in a larval stage, which is dependent on one host plant, habitat mapping focused on locations of johnny jump-ups (Entomological Consulting Services 2004a, p. 6; 2004b, p. 5). Johnny jump-ups were found primarily growing in grasslands, valley oak woodland, and mixed evergreen forest/oak woodland (Entomological Consulting Services 2004b, p. 8).

After the study area for the CDRP was defined, additional habitat mapping was conducted in 2006 (ETJV 2006a). Because the surveys were more focused, the mapping conducted in 2006 was more refined and identified several much smaller habitat patches than those identified in 2004. The minimum mapping unit was 0.01 acre (500 square feet) for the larval host plant for callippe silverspot in the study area.

A total of 10.8 acres of potential larval habitat were mapped within the study area (see Figure 4.4.5, Callippe Silverspot Butterfly Habitat in the Project Vicinity). Most of the potential habitat consists of small (less than 0.25 acre) stands of johnny jump-ups interspersed within grassland habitats, with some stands occurring in oak woodlands. The largest stands in the study area occur to the north, west, and south of Calaveras Reservoir. Two very small stands occur at the northern end of the study area, to the west of Calaveras Road (ETJV 2006a). Arnold mapped larger stands of johnny jump-ups within the extended study area to the east of the study area (Entomological Consulting Services 2004a, p. 9).

California Red-Legged Frog

Extirpated from over 70 percent of its former range in California, the California red-legged frog is currently listed by the USFWS as a federally threatened species (USFWS 1996). The CDFG considers the California red-legged frog as a species of special concern (CNDDB 2009b).



SOURCE: ETJV 2006a; Entomological Consulting Services 2004a.

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**FIGURE 4.4.5: CALLIPPE SILVERSPOT BUTTERFLY HABITAT
IN THE PROJECT VICINITY**

Eastern Contra Costa and Alameda Counties (especially east of Interstate 680 [I-680]) contain the majority of known California red-legged frog localities within the San Francisco Bay Area (USFWS 2002b, p. 8).

Within its current range, this species is threatened by a wide range of human activities and associated impacts. Urban expansion, livestock grazing, agricultural practices, and stream alteration can lead to habitat loss, fragmentation, and the introduction of predators, which may ultimately threaten the viability of California red-legged frog populations. Although grazing may contribute to the decline of this species, in some cases grazing can be a beneficial tool for red-legged frog habitat management (USFWS 2002b, p. 20). In a recent study, EBRPD was unable to find that grazing had a negative effect on California red-legged frog occurrence and, in fact, EBRPD often found an “explosion” of breeding in ponds exposed to grazing (EBRPD 2007, p. 27).

Federally designated critical habitat for the California red-legged frog consists of four PCEs⁸ that are essential to the conservation of the species: (1) aquatic breeding habitat, (2) non-breeding aquatic habitat, (3) upland habitat, and (4) dispersal habitat (USFWS 2006c).

Aquatic Breeding Habitat

California red-legged frogs are aquatic breeders, using ponds or pond-like areas of marshes, creeks and streams, lagoons, or other slow-moving water for breeding and egg deposition. Typically, California red-legged frogs prefer aquatic habitats with abundant riparian or emergent vegetation although they are known to use some stock ponds despite a lack of emergent vegetation cover (USFWS 2002b, p. 12). However, EBRPD has documented the greatest abundance of California red-legged frog in ponds with less than 15 percent cover of emergent vegetation (EBRPD 2007, p. 22). Local conditions determine when and where eggs are deposited, but California red-legged frogs typically attach egg masses to emergent vegetation near the surface of the water between late November and late April (Jennings and Hayes 1994, p. 62). In Alameda Creek, EBRPD has observed that peak egg deposition occurs from mid- to late-March (EBRPD 2007, p. 35). As with egg deposition, larval development is highly variable and may be regulated largely by water temperature. Typically, tadpole development takes between 3 and 7 months, so metamorphosis takes place between May and September depending on timing of egg deposition and hatching. Because tadpoles take several months to develop, aquatic habitat (used for breeding) must remain inundated well into the summer (USFWS 2002b, p. 152).

⁸ Habitat descriptions in this chapter only refer to PCEs for species that are listed under the federal ESA and have federally designated critical habitat: California red-legged frog, California tiger salamander, and Alameda whipsnake.

Non-Breeding Aquatic Habitat

Non-breeding aquatic habitat provides the space, food, and cover necessary to sustain California red-legged frogs during drought periods or when they disperse to other breeding habitat. It includes fresh water habitats that may or may not hold water long enough for the species to hatch and complete its aquatic life cycle but that provide for shelter, foraging, predator avoidance, and aquatic dispersal for juveniles and adults. Aquatic non-breeding habitat includes but is not limited to: plunge pools within intermittent creeks, seeps, quiet water refugia during high water flows, and springs of sufficient flow to withstand the summer dry period. California red-legged frogs can use large cracks in the bottom of dried ponds as refugia to maintain moisture and avoid heat and solar exposure (USFWS 2006c, pp. 19262–19263).

Upland Habitat

California red-legged frogs forage and seek refuge in upland areas located within 1 mile of aquatic breeding and non-breeding habitats. Upland habitat includes natural and manmade structures that provide shade, moisture, and cooler temperatures. Structures that provide desiccation and thermal protection include downed woody debris, vegetation, abandoned sheds, deep cracks in dried ponds, and small mammal burrows (USFWS 2008, pp. 53498). Upland habitat is defined by the USFWS as “(u)pland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile (1.6 kilometers) in most cases and comprised of various vegetational series such as grasslands, woodlands, wetland, or riparian plant species that provides the frog shelter, forage, and predator avoidance.” Upland habitat often contains blackberry (*Rubus* sp.) and other upland perennial species that provide forage habitat and shelter from predatory species.

Dispersal Habitat

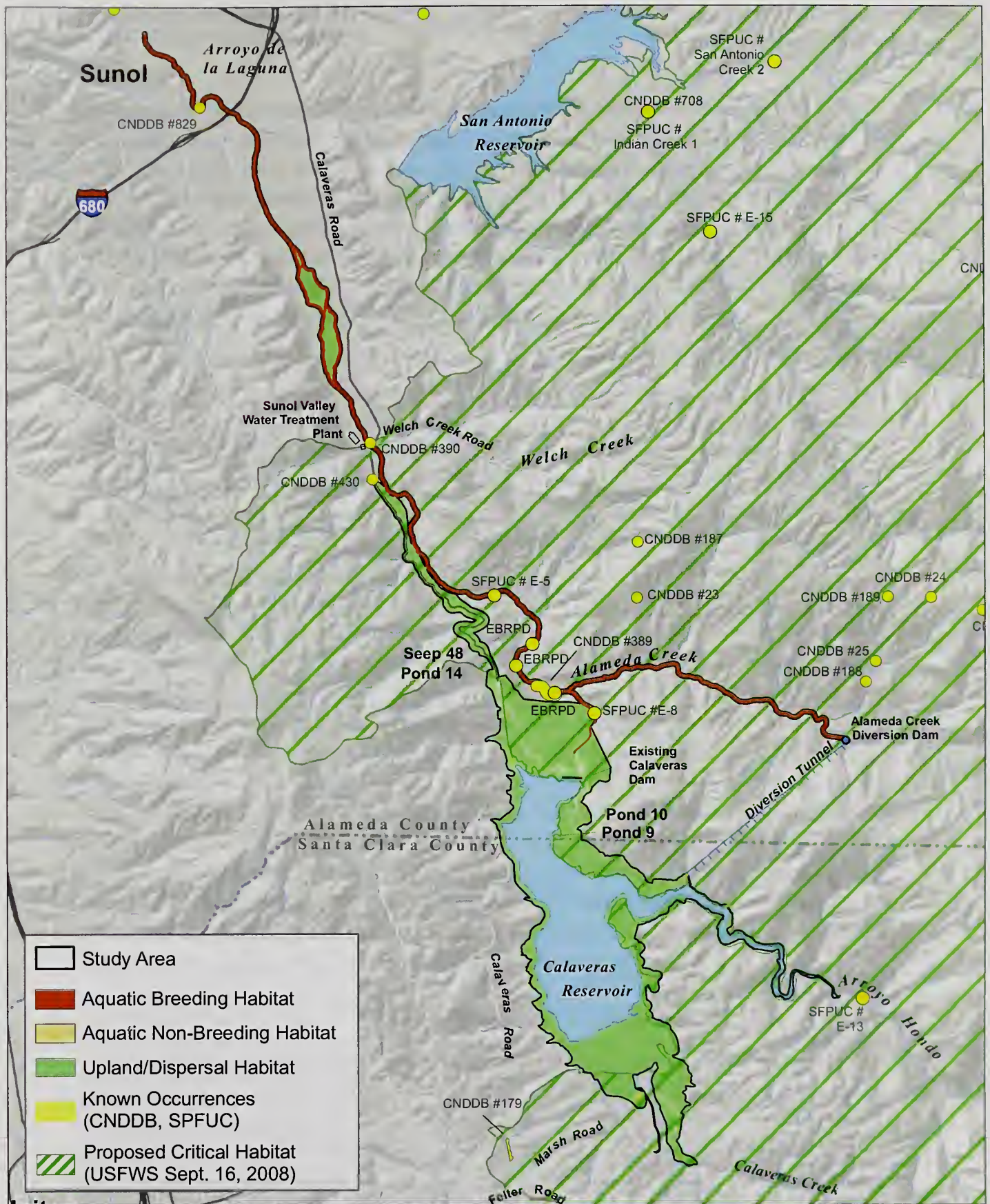
California red-legged frogs disperse substantial distances between breeding locations. Dispersal habitat provides connectivity among California red-legged frog breeding (and associated upland) habitat patches. Dispersal habitat provides opportunities for the California red-legged frog to move freely across the landscape in search of adjacent breeding and non-breeding habitats. Accessible dispersal habitat is considered essential to the conservation of the species and provides for: (1) opportunities for movement and establishment of home ranges by juvenile recruits, (2) maintaining gene flow by the movement of both juveniles and adults between subpopulations, and (3) re-colonization of or recruitment into breeding habitat after local extirpations. While California red-legged frogs can pass many obstacles and do not require a particular type of habitat for dispersal, the habitat connecting breeding locations and other aquatic habitat must be free of barriers that prevent California red-legged frogs from dispersing. Designated dispersal habitat consists of upland and riparian habitat contiguous with breeding and non-breeding aquatic habitat that is free of barriers and that connects two or more patches of aquatic breeding habitat within 0.7 mile of one another. Dispersal barriers include heavily traveled roads that possess no bridges

or culverts, moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete that do not contain the other habitat elements essential to the species, and large reservoirs over 50 acres in size that contain predatory species. Agricultural lands such as row crops, orchards, vineyards, and pastures do not constitute barriers to California red-legged frog dispersal. California red-legged frogs have been documented to travel as far as 2.2 miles from non-breeding to breeding habitats. However, the USFWS has determined that 2.2 miles is likely the upward limit of dispersal capability for the California red-legged frog and that a 0.7-mile dispersal distance is sufficient to maintain connectivity between breeding habitats. EBRPD used radio telemetry to study California red-legged frog movement on park lands, including Alameda Creek at Camp Ohlone. Most frogs moved either relatively little or up to several hundred yards, mostly within the stream system (EBRPD 2007, pp. 27–28).

On behalf of the SFPUC, in spring 2006 EDAW biologists conducted field work for a California red-legged frog habitat assessment within 1.2 miles of proposed construction, revisiting some sites in 2007. Focused surveys for California red-legged frogs within the study area have not been conducted. Several sources providing information about the regional population of California red-legged frog were also reviewed during preparation of this EIR, including CNDDDB records, surveys conducted by EBRPD biologists, and incidental sightings by SFPUC within the watershed (see Figure 4.4.6, California Red-Legged Frog Occurrences, Habitat, and Critical Habitat).

The CNDDDB contains several records of California red-legged frog outside of the primary study area (Figure 4.4.6) but within several miles of the project. Most of these records are from stock or spring-fed ponds on EBRPD lands to the east of the study area or from tributaries to San Antonio Reservoir to the northeast of the study area. A few occurrences are reported at stock ponds south of Calaveras Reservoir and downstream of I-680 on Alameda Creek (CNDDDB 2009a).

In 1990, the EBRPD initiated long-term and extensive surveys for California red-legged frog on its lands. These studies are an attempt to further understand the species' habitat requirements, dispersal patterns, and threats, and to help preserve and protect the California red-legged frog (EBRPD 2006, p. 2). EBRPD has documented California red-legged frogs throughout the Alameda Creek watershed in both artificial ponds and in deep-water pools of creeks. EBRPD biologists have also found California red-legged frog using mammal burrows on EBRPD land adjacent to the study area (EBRPD 2007, p. 28). In addition to these records, California red-legged frogs have also bred in a ponded area at the confluence of Alameda Creek and Calaveras Creek (DiDonato, pers. com.) (see Figure 4.4.6).



SOURCE: ETJV unpublished data 2009, CNDDDB 2009a, EBRPD unpublished data, and USFWS 2008.

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FIGURE 4.4.6: CALIFORNIA RED-LEGGED FROG OCCURRENCES, HABITAT AND CRITICAL HABITAT

SFPUC staff have captured several California red-legged frogs while conducting fisheries studies in the Alameda Creek watershed (Figure 4.4.6). Capture locations include Arroyo Hondo downstream of Marsh Road and upstream of the reservoir, pool habitat along Alameda Creek near the EBRPD interpretive center, and a pool on Calaveras Creek downstream of the dam. They have also documented California red-legged frog in fish traps and while electrofishing in San Antonio Creek and Indian Creek, northeast of the study area. Based on these data sources, there are six known occurrences of California red-legged frogs within or adjacent to the study area (CNDDB 2009a; SFPUC unpublished data; DiDonato, pers. com.). These occurrences are summarized in Table 4.4.2.

Table 4.4.2: Known California Red-Legged Frog Occurrences

Location	Source	Date of Last Occurrence	Number of Adults	Number of Subadults / Juveniles	Number of Tadpoles / Larvae
Large, deep pools on Alameda Creek, at Calaveras Creek confluence	CNDDB (occurrence number 389)	23 October 1998	None	4	None
	EBRPD surveys	unknown	Documented breeding but numbers of individuals for each life stage not reported		
Pool, riffle/run area on Alameda Creek at Welch Creek confluence	CNDDB (occurrence number 390)	23 October 1998	None	1	11
Alameda Creek, 0.6 mile downstream of the San Antonio Creek confluence	CNDDB (occurrence number 829)	17 May 1999	1	None	None
Calaveras Creek, downstream of Calaveras Dam	SFPUC electrofishing station E-8	4 October 2005	1	None	None
Alameda Creek, near EBRPD interpretative center	SFPUC electrofishing data	6 October 2003	2	None	None
Arroyo Hondo, downstream of Marsh Road bridge	SFPUC electrofishing data	7 February 2005	1	None	None

Sources: CNDDB 2006a; SFPUC unpublished data; DiDonato, pers. com.

Surveys in support of a habitat assessment for California red-legged frog for the CDRP were conducted in April and May 2006 (ETJV unpublished data 2007). Methods used to conduct the habitat assessment followed USFWS' *Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog* (USFWS 2005c). The approach and results were similar to those for the draft AWHCP (Jones & Stokes 2006, p. 3-57). Additional field work was conducted by ETJV in March and April 2007 to evaluate several ponds identified in reports by Jones & Stokes (2006) and LSA (1994) that were not included in the 2006 field work, to evaluate creek

habitat inaccessible in 2006, and to re-evaluate seasonal wetland and seep wetland habitat identified in 2006.

Based on this evaluation, habitat for red-legged frog in the study area was classified as aquatic breeding, aquatic non-breeding, upland, and dispersal (see Figure 4.4.6 and Table 4.4.3). Classifications follow the descriptions of these habitats presented earlier in this species description. Habitat is further described in Table 4.4.3 as unimpaired or impaired, depending on site-specific conditions.

Most of the aquatic breeding habitat in the project area is in the creeks. California red-legged frogs are known to breed in Alameda Creek upstream of and downstream of the confluence with Calaveras Creek, and have been documented in Calaveras Creek downstream of the dam and in Arroyo Hondo. EBRPD (2007, p. 35) has studied factors influencing California red-legged frog breeding at two reaches on Alameda Creek: a 1-mile reach at Camp Ohlone (about 2 miles upstream of the ACDD) which is not influenced by large water diversions, and a 2-mile reach at the Sunol Visitor Center, downstream of the confluence with Calaveras Creek, where flows are modified by diversions at the ACDD and releases from Calaveras Dam. Compared to Camp Ohlone, which had 0-24 egg masses per year from 2000 to 2006, the Sunol reach had fewer sites where egg masses were deposited (0-7) and considerably lower reproductive output (EBRPD 2007, p. 37). Lower reproduction would be correlated to fewer sites for depositing egg masses but is also influenced by streamflow volume and duration. During very high flows in 2005, reproduction at Camp Ohlone was consistent with previous years even though on 2 days flows were notably higher than the median streamflow in the previous 9 years (EBRPD 2007, p. 38). In the Sunol reach, flows for the entire month of March 2005 were substantially higher than the median during the previous 4 years, flowing at or above 300 cfs except for a few days. These sustained flows corresponded to sustained releases from Calaveras Dam of 375 cfs. Egg deposition was lower during this period, and the two documented California red-legged frog egg masses in the Sunol reach were destroyed by high flows (EBRPD 2007, p. 39). This suggests that California red-legged frogs can use breeding habitat in creeks that experience some naturally occurring, short-duration high flows but not long-duration high flows.

California red-legged frogs have been documented by SFPUC fisheries biologists as present in Arroyo Hondo, but breeding has not been confirmed. California red-legged frogs have been documented breeding in Calaveras Creek on EBRPD land (DiDonato, pers. com.); SFPUC fisheries biologists have documented one occurrence between the confluence and dam, but breeding was not confirmed. California red-legged frog habitat in these creeks was evaluated by EDAW in October 2006 and April 2007. Calaveras Creek downstream of the dam is a very short reach (approximately 0.6 mile) consisting of steep rocky gorge-type topography with bedrock and large boulders; at the confluence with Alameda Creek, on EBRPD land, there is a large backwater pool. Stream hydrology is highly altered by the operations of Calaveras Reservoir, with low base

Table 4.4.3: Habitat Classification for California Red-Legged Frog in the Calaveras Dam Replacement Project Study Area

Habitat Element	Definition	Location	Description
Aquatic Breeding	Standing fresh water including natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks. Includes aquatic breeding habitat within 200 feet of the study area. Does not include deep lakes and reservoirs ≥ 50 acres.	Ponds 9 and 10	Impaired: bullfrogs present
		Pond 14	Unimpaired
		Calaveras Creek downstream of the dam to confluence with Alameda Creek	Impaired by non-native predatory fish and bullfrogs in large pools immediately downstream of the dam and at the confluence with Alameda Creek. Few pools present; species has been detected breeding in this reach.
		Arroyo Hondo	The reach in the project area contains breeding sites and is impaired by presence of bullfrogs; species has been detected upstream of study area.
		Alameda Creek	Impaired by presence of non-native predatory fish and bullfrogs downstream of Little Yosemite. Breeding habitat quality varies in Alameda Creek; fewer egg masses are found in the Sunol reach compared to the reach at Camp Ohlone.
Aquatic Non-breeding	Freshwater habitats that may or may not hold water long enough for California red-legged frog to complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs.	Intermittent and shallow perennial streams, seep wetlands, and freshwater marsh	Mostly unimpaired. Bullfrogs have been documented in Calaveras Creek upstream of reservoir. This habitat is located throughout the study area. Freshwater marsh in the project area does not contain pools of water deep enough for breeding.
Upland	Upland areas that provide shelter, forage, and predator avoidance within 1 mile of the breeding or non-breeding aquatic habitat.	1 mile from locations listed as aquatic breeding and non-breeding habitat	Mostly unimpaired. Small areas developed around the dam provide limited upland values.
Dispersal ¹	Accessible upland or riparian dispersal habitat between aquatic habitat locations within 1 mile of each other. Does not include reservoirs ≥ 50 acres.	Uplands 1 mile from aquatic habitat features where other aquatic habitat is located within 1 mile	Impaired; Calaveras Reservoir is a substantial barrier to upland dispersal.
<i>Note:</i> ¹ Includes aquatic habitat 0.7 mile outside of the study area for purposes of calculating dispersal habitat within the study area.			

Source: ETJV unpublished data 2007

flows except during periods when the water had been released from the reservoir through the cone valve to maintain DSOD-required surface elevations; prior to DSOD restrictions, high flows also occurred during occasional spills over the spillway. At low flows (without releases from the dam), habitat for California red-legged frog consists of vegetated pools. Habitat is limited by variations in stream hydrology resulting from dam releases, and by the presence of bullfrogs and non-native predatory fish in various sections of the reach, especially immediately downstream of the dam and at the confluence with Alameda Creek.

Arroyo Hondo is a moderate-gradient stream with perennial flow, primarily gravel and cobble substrate with side pools and backwaters, and relatively dense riparian vegetation. Below the pre-DSOD restricted 756-foot storage elevation, Arroyo Hondo exhibits conditions that are a result of previous inundation, including shallow riffles and glides and sparse riparian vegetation cover on the adjacent floodplain and bars; these conditions become more pronounced at lower elevations. The amount and quality of Arroyo Hondo habitat in the study area vary with reservoir height. The lower half of Arroyo Hondo in the study area is still periodically inundated by the reservoir and has little riparian or perennial aquatic vegetation and only a few potential breeding locations; the upper half is not currently subject to inundation and has more potential breeding locations. A habitat assessment conducted by EDAW in spring 2007 found 4 potential breeding locations in the lower half of Arroyo Hondo and 10 in the upper reach. Habitat is poorer at lower elevations due to periodic inundation and the scarcity of established aquatic vegetation.

Specific threats to California red-legged frog in the east San Francisco Bay region include livestock grazing, non-native predators, urbanization, water management, diversions, and reservoirs (USFWS 2002b). Regional, county, and city park districts and regional water and municipal utility districts are recognized in the 2002 recovery plan as contributing to California red-legged frog habitat management in the region. Specific management actions being taken by these agencies include preparing Habitat Conservation Plans (HCPs), maintaining water levels in ponds, removing predatory fishes, reducing grazing impacts, minimizing human disturbances, planting wetland and riparian vegetation, offering public education programs, and developing guidelines for fire management practices to decrease incidental impacts on California red-legged frogs (USFWS 2002b).

EBRPD is implementing management actions to improve California red-legged frog (and California tiger salamander) habitat on their land by allowing moderate grazing around and in ponds so as to maintain access to upland burrows and to reduce vegetation in the ponds. Bullfrog management is also conducted in breeding ponds to reduce predation and competition pressure on California red-legged frog. Bullfrog removal by seining, draining ponds, using dip nets, shooting, and hand capturing has had limited success. EBRPD has had best success with draining ponds followed by smothering any remaining bullfrogs with a layer of soil. EBRPD drains the ponds in late fall, after the tadpoles have metamorphosed, caps the ponds with soil, and allows the ponds to

fill with winter rains. They have documented breeding California red-legged frog and California tiger salamander in ponds the year after this treatment is applied (DiDonato, pers. com.).

California Tiger Salamander

The California tiger salamander is federally listed as threatened throughout its range except in Sonoma and Santa Barbara Counties where it is listed as endangered (USFWS 2004, p. 47217; 2005a, p. 49380). The CDRP is located within the range of the central population of California tiger salamander (USFWS 2005a). The CDFG lists the California tiger salamander as a candidate for listing as an endangered species under CESA (CNDDDB 2009b). Federally designated critical habitat for the central population of California tiger salamander consists of three PCEs that are essential to the conservation of the species: (1) aquatic and breeding habitats, (2) upland habitat, and (3) dispersal habitat (USFWS 2005a, pp. 49390-391).

Aquatic and Breeding Habitat

Aquatic and breeding habitats provide space, food, and cover necessary to support reproduction and to sustain early life history stages of larval and juvenile California tiger salamander. These habitats consist of fresh water bodies, including natural and artificially made (e.g., stock) ponds, vernal pools, and vernal pool complexes. To be considered essential, aquatic and breeding habitats must have the capability to hold water for a minimum of 12 weeks in the winter or spring in a year of average rainfall, which is the amount of time needed for salamander larvae to metamorphose into juveniles capable of surviving in upland habitats. During periods of drought or less-than-average rainfall, these sites may not hold water long enough for individuals to complete metamorphosis.

Dispersal from upland habitat to breeding sites begins with the first rain events of the fall/winter. In the East Bay, California tiger salamanders may lay eggs twice, once in December and the second time in February (Bobzien 2003 *in* USFWS 2004, p. 47214). Adults can spend a couple of weeks actively feeding near breeding sites, post egg-laying, before returning to subterranean refuges. California tiger salamander larvae feed on zooplankton, small crustaceans, or small aquatic insects until the salamanders grow large enough to feed on larger food items (USFWS 2004, p. 47215). Habitats that dry completely in the late summer/fall and do not support breeding populations of non-native predators that require permanent water, such as fish or bullfrogs, are particularly important California tiger salamander breeding habitats (USFWS 2004, p. 47216).

Upland Habitat

Adult and juvenile California tiger salamanders are primarily terrestrial; adult California tiger salamanders enter aquatic habitats only for relatively short periods of time to breed. For the majority of their life cycle, California tiger salamanders survive within upland habitats containing underground refugia in the form of small mammal burrows. These underground refugia provide

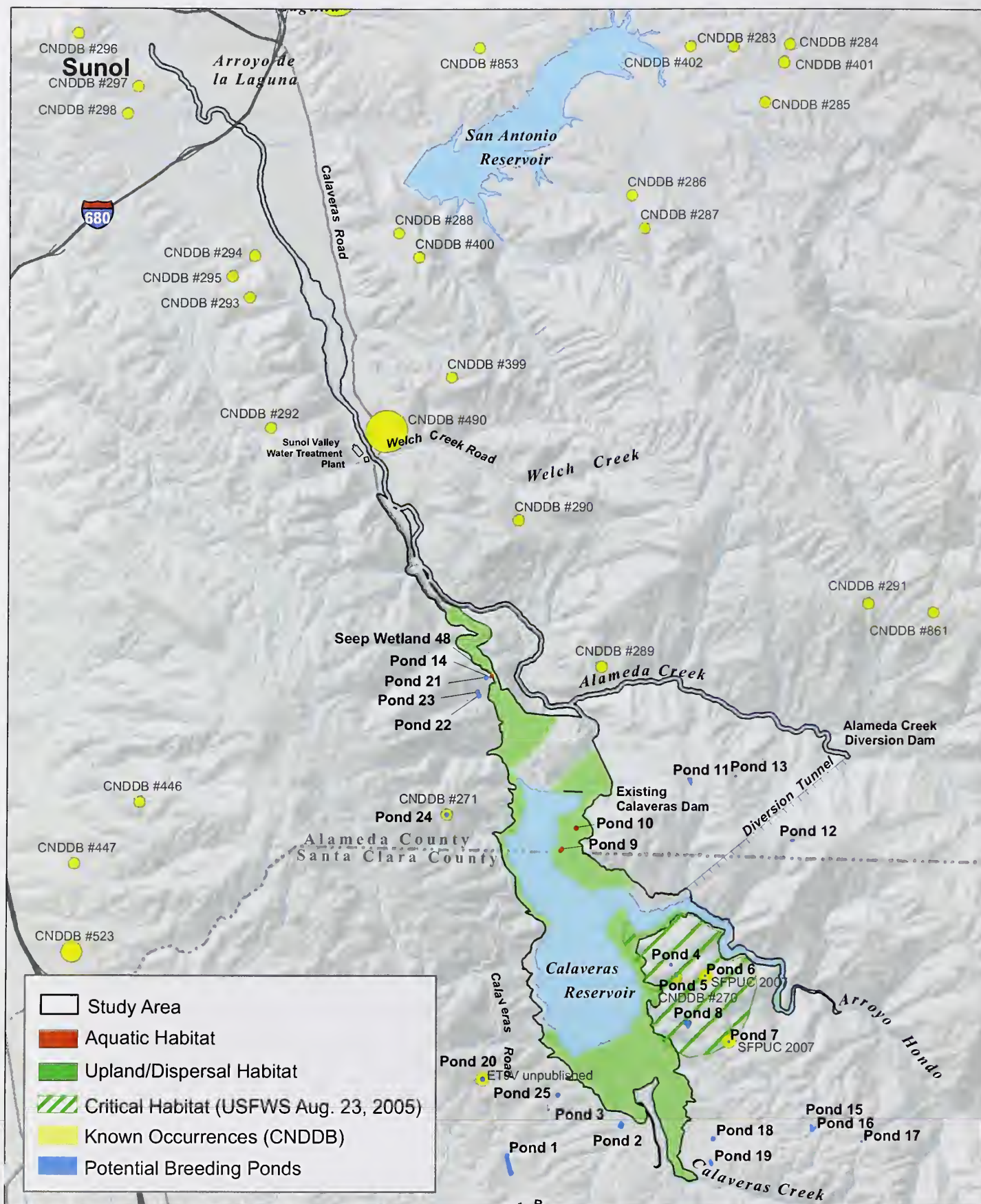
protection from the hot, dry weather typical of California in the non-breeding season. California tiger salamander may also forage in the small mammal burrows and rely on the burrows for protection from predators. The presence of small burrowing mammal populations is essential for constructing and maintaining burrows. Without the continuing presence of small mammal burrows in upland habitats, the California tiger salamander would not be able to survive.

Dispersal Habitat

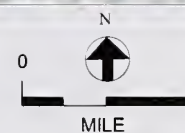
Dispersal habitat provides connectivity among California tiger salamander aquatic and upland habitats. The distance California tiger salamanders will travel between aquatic and upland refugia habitats varies greatly between sites (USFWS 2004, p. 47216). In defining critical habitat for California tiger salamanders, USFWS used a distance of 0.7 mile from known occurrences of the species that are not isolated by barriers that California tiger salamanders cannot cross. This distance would likely include 99 percent of the inter-pond movement of breeding adults. While California tiger salamanders can bypass many obstacles and do not require a particular type of habitat for dispersal, the habitats connecting essential aquatic and upland habitats need to be free of barriers (e.g., physical or biological features that prevent salamanders from dispersing beyond the features) to function effectively. An example of a barrier is steep topography devoid of soil or vegetation. Agricultural lands such as row crops, orchards, vineyards, and pastures do not constitute barriers to the dispersal of California tiger salamander.

Protecting the ability of the California tiger salamander to move freely across the landscape in search of aquatic and upland habitats is essential in maintaining gene flow and for re-colonization of sites that may become temporarily extirpated. While individuals may survive for more than 10 years, many breed only once. Combined with low survivorship of metamorphosed individuals, reproductive output in most years is not sufficient to maintain populations. Isolated populations are susceptible to unusual, randomly occurring natural events, as well as human-caused factors that reduce breeding success and individual survival. Factors that repeatedly lower breeding success in isolated breeding habitat can quickly extirpate an occurrence of the species.

Habitat for California tiger salamander in the study area was classified as aquatic and breeding, upland, and dispersal (see Figure 4.4.7, California Tiger Salamander Occurrences, Habitat, and Critical Habitat, and Table 4.4.4). Classifications follow the descriptions of these habitats presented earlier in this species description. Habitat is further described in Table 4.4.4 as unimpaired or impaired, depending on site-specific conditions.



SOURCE: ETJV unpublished data 2007 and 2009, CNDDDB 2009a, USFWS 2005a.



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.4.7: CALIFORNIA TIGER SALAMANDER OCCURRENCES, HABITAT, AND CRITICAL HABITAT

Table 4.4.4: Habitat for California Tiger Salamander in the Calaveras Dam Replacement Project Study Area

Habitat Element		Definition	Location	Description
Aquatic		Ponds and other ephemeral or permanent water bodies which typically support inundation during winter rains and hold water for a minimum of 12 weeks in a year of average rainfall	Ponds 9 and 10	Impaired: bullfrogs present
			Pond 14	Unimpaired
Upland ¹	Refuge and Forage	Upland habitats adjacent to and accessible to and from breeding ponds that contain small mammal burrows or other underground habitat that California tiger salamanders depend upon for food, shelter, and protection from the elements and predation	Undeveloped vegetated uplands 0.7 mile from aquatic habitat where other aquatic habitat is located within 0.7 mile and there are no barriers to movement	Unimpaired for refuge and foraging; small mammal burrows are present.
	Dispersal	Accessible upland habitat between aquatic habitat locations within 0.7 mile of each other	All remaining uplands within 0.7 mile from aquatic habitat where there are no barriers to movement	Barriers to upland dispersal include Calaveras Reservoir and Calaveras Dam and spillway, and Calaveras Creek downstream of the dam where deep pools are present.
<i>Note:</i> ¹ Includes aquatic habitat 0.7 mile outside of the study area for purposes of calculating upland habitat within the study area.				

Source: ETJV unpublished data 2007

LSA (1994) conducted focused surveys for California tiger salamander at 32 sites in the Calaveras Reservoir watershed. California tiger salamander larvae were found in nine ponds breeding locations are very near Calaveras Reservoir. The first known breeding location, Pond 5, is located less than 0.5 mile east of Calaveras Reservoir, south of Arroyo Hondo, and is described as a 30-foot-by-15-foot seasonal stock pond in grazed non-native grassland. More than 20 tiger salamander larvae were observed on May 2, 1994 (CNDDDB 2009a, occurrence number 270). The second known breeding location, Pond 24, is approximately 0.5 mile west of Calaveras Reservoir and 0.5 mile north of the Alameda/Santa Clara County line. The breeding habitat consists of a 125-foot-by-90-foot seasonal stock pond in non-native grassland. More than 300 larvae were observed on May 2, 1994 (CNDDDB 2009a, occurrence number 271). The CNDDDB includes occurrences for several other breeding locations in stock ponds in the area surrounding the study area, including several locations on SFPUC land west of Alameda Creek north of the SVWTP and near San Antonio Reservoir, and on EBRPD lands in the Ohlone Wilderness Regional Preserve (Ohlone Wilderness), the Sunol Wilderness, and the Mission Peak Regional Preserve (CNDDDB 2009a).

In spring 2007 and 2008, surveys for the California tiger salamander were conducted on behalf of the SFPUC at ponds near Calaveras Reservoir and in Sunol Valley in support of the SFPUC's Habitat Reserve Program (HRP) (Condor Country Consulting 2008). California tiger salamanders were not detected in most of the ponds surveyed, but its presence was detected in several ponds, including two east of the study area.

An additional record of the California tiger salamander was documented in Pond 24 (Figure 4.4.7) by EDAW biologists on March 21, 2007, during field work to update a California tiger salamander habitat assessment (described in the following section). While documenting conditions at a pond near the south end of Calaveras Reservoir but west of Calaveras Road, biologists observed an adult California tiger salamander surfacing several times. The pond is approximately 30 feet by 60 feet and is located in grazed grasslands with abundant ground squirrel burrows. It contained very turbid water but no obvious aquatic or emergent vegetation. This pond was surveyed by LSA in 1994 and found to contain only pacific treefrog (*Hyla regilla*) larvae. It was seined on April 3 and 17 and May 1 and 2, 2007 by SFPUC, and no California tiger salamanders or predators were detected.

In 1990, EBRPD initiated extensive aquatic habitat surveys of their land in Alameda and Contra Costa Counties. Systematic surveys for California tiger salamanders were conducted in 1996, 2000, and 2004. EBRPD biologists found evidence of California tiger salamander breeding in 75 of 170 potentially suitable ponds (EBRPD 2007, p. 2), but only 44 to 50 percent of available ponds were occupied in any given year. Surveys in 2004 demonstrated that most ponds occupied by California tiger salamanders (21 of 33) had less than 5 percent emergent vegetation, and no California tiger salamander were detected in ponds with more than 35 percent emergent vegetation. Similarly, 27 of 33 California tiger salamander ponds had less than 5 percent submerged vegetation (EBRPD 2007, p. 13).

A habitat assessment for California tiger salamander in the study area was conducted in April and May 2006 (ETJV unpublished data 2007), following USFWS and CDFG's *Interim Guidance on Site Assessments and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander* (USFWS and CDFG 2003). This assessment was conducted concurrently with an assessment for California red-legged frog and followed the same methodology of identifying potential aquatic habitat from the wetland delineation conducted for the CDRP (ETJV 2006b) and using aerial photos to identify potential aquatic habitat 1.2 miles from the study area. (See the description under "California Red-Legged Frog" in this section for more details.)

Table 4.4.5 summarizes the results of the habitat assessment for ponds suitable as aquatic habitat for California tiger salamander. The results of previous surveys for California tiger salamanders at each pond are also presented in this table. This information was used to categorize habitats described in Table 4.4.4.

4. Environmental Setting and Impacts
4. Vegetation and Wildlife – Setting

Table 4.4.5: California Tiger Salamander Habitat Summary for Aquatic Habitat Within 1.2 Miles of the CDRP Study Area

Feature ¹	Surveyor	Survey Type ²	Date	CTS Detected	Predators Detected/Notes
Pond 1	LSA SFPUC EDAW	Seine Seine Assessment	April/May 1994 Spring 2007, 2008 4/24/06	No No N/A	None Bullfrog, fish >40 bullfrogs
Pond 2	LSA SFPUC EDAW	Seine Seine Assessment	April/May 1994 Spring 2007, 2008 4/25/06	No No N/A	Bullfrog Bullfrog, fish ~30 bullfrogs
Pond 3	SFPUC EDAW	Seine, egg Assessment	Spring 2007, 2008 4/25/06	No N/A	None None
Pond 4	LSA SFPUC EDAW	Seine Seine, egg Assessment	April/May 1994 Spring 2007, 2008 4/25/06	No No N/A	None Bullfrog 5 bullfrogs
Pond 5	LSA SFPUC EDAW	Seine Seine, egg Assessment	April/May 1994 Spring 2007, 2008 4/25/06	Yes No N/A	20+ CTS, no pred None None
Pond 6	LSA SFPUC EDAW	Seine Seine, egg Assessment	April/May 1994 Spring 2007, 2008 4/25/06	No Yes N/A	None None 1 bullfrog
Pond 7	LSA SFPUC EDAW	Seine Seine, egg Assessment	April/May 1994 Spring 2007, 2008 4/25/06	No Yes N/A	None None 3 bullfrogs
Pond 8	LSA SFPUC EDAW	Seine Seine Assessment	April/May 1994 Spring 2007, 2008 4/25/06	No No N/A	Bullfrog larvae/ad Bullfrog, fish Dead bass, catfish
Pond 9	SFPUC EDAW	Seine, egg Assessment	Spring 2007, 2008 4/26/06; 3/21/07	No N/A	Pond was dry. None
Pond 10	SFPUC EDAW	Seine Assessment	Spring 2007, 2008 4/26/06; 3/21/07	No N/A	None 1 bullfrog; none
Pond 11	LSA EDAW	Seine Assessment	April/May 1994 4/27/06; 5/10/07	No N/A	None Fish, likely bass; none
Pond 13	EDAW	Assessment	4/27/06; 5/10/07	N/A	None; none
Pond 14	EDAW	Assessment	5/03/06; 3/21/07	N/A	None; none
Pond 18	LSA SFPUC EDAW	Seine Seine, egg Assessment	April/May 1994 Spring 2007, 2008 5/4/06	No No N/A	None Mosquitofish 30 bullfrogs
Pond 19	SFPUC EDAW	Seine, egg Assessment	Spring 2007, 2008 5/4/06	No N/A	Likely bass skeleton 10 bullfrogs, dead bass
Pond 20	LSA SFPUC EDAW	Seine Seine, egg Assessment	April/May 1994 Spring 2007, 2008 3/21/07	No No Yes	None None CTS observed, no pred
Pond 21	EDAW	Assessment	3/21/07	N/A	None
Pond 22	EDAW	Assessment	3/21/07	N/A	None
Pond 23	EDAW	Assessment	3/21/07	N/A	Mosquitofish
Pond 24	LSA EDAW	Seine Assessment	April/May 1994 3/21/07	Yes N/A	300+ CTS, no pred Mosquitofish
Pond 25	SFPUC EDAW	Seine, egg Assessment	Spring 2007, 2008 3/6/07; 5/10/07	No N/A	None None; dry by 5/10/07
Seep Wetland 48	EDAW	Assessment	5/3/06; 3/21/07	N/A	None; none

Notes: CTS = California tiger salamander.

¹ Corresponds to feature numbers shown in Figure 4.4.7.

² Seine and egg surveys are designed to document presence or absence of California tiger salamander, but habitat assessment methods are not. However, California tiger salamander presence was documented during a habitat assessment on one occasion, at Pond 20.

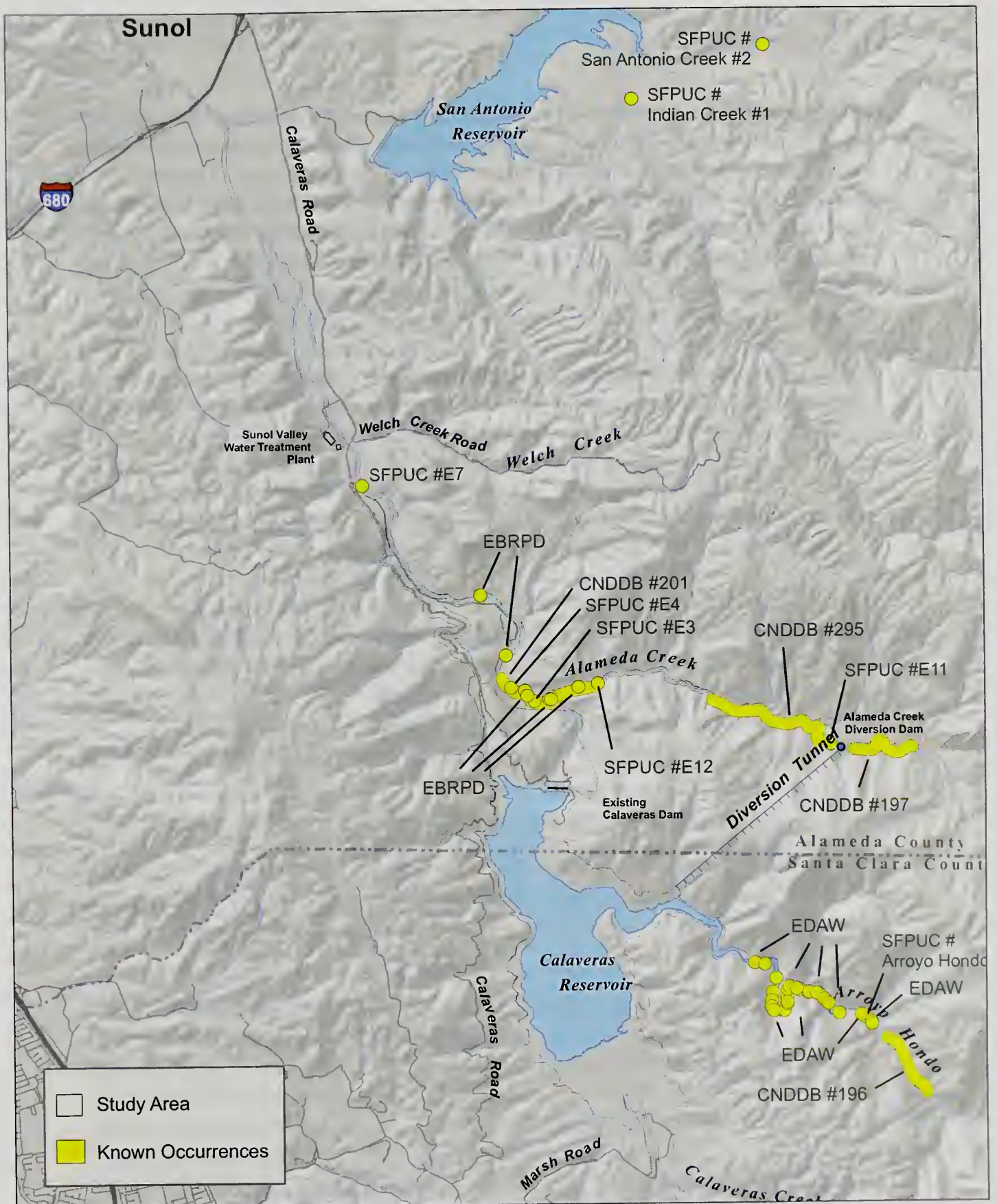
Source: ETJV unpublished data 2007

Final critical habitat for California tiger salamander was designated on August 23, 2005 (USFWS 2005a, p. 49380). Critical habitat Unit 3 (East Bay Region) is immediately outside of the study area, to the east of Calaveras Reservoir, south of Arroyo Hondo. This unit is described as essential to the conservation of the species because it is needed to maintain the current geographic and ecological distribution of the species within the Bay Area Geographic Region (USFWS 2005a, p. 49400). This unit contains several extant occurrences of California tiger salamander (Figure 4.4.7). Three occurrences are referenced in the critical habitat designation (USFWS 2005a), but only one was reported to the CNDDDB. A survey conducted for SFPUC in 2007 and 2008 identified two more occupied ponds (Condor Country Consulting 2008). The description of the unit incorrectly identifies the land ownership as a mixture of county parks and private lands (USFWS 2005a, p. 49400). EDAW has determined that the unit is entirely under the ownership of the SFPUC. The unit is threatened by infrastructure improvements along Marsh Road associated with development of private property on Oak Ridge. Feral pig and bullfrog populations in the unit could require special management because of their potential impact on California tiger salamander breeding success (USFWS 2005a, p. 49400).

As discussed for the California red-legged frog, EBRPD is actively managing breeding ponds on its lands to enhance habitat for California tiger salamander. California tiger salamander breeding success has been promoted by draining and capping of ponds during the fall to eliminate bullfrogs and using moderate grazing to reduce vegetation (DiDonato, pers. com.). Grazing reduces vegetation height, helps facilitate salamander access to upland burrow sites, and has the added benefit of reducing aquatic vegetation, which seems to be correlated with reductions of predaceous aquatic invertebrate (e.g., water scavenger beetles) populations. Predaceous aquatic invertebrates appear to negatively affect California tiger salamander breeding success (EBRPD 2007, p. 11).

Foothill Yellow-Legged Frog

Foothill yellow-legged frog is a California species of special concern that occurs in the Coast Ranges from the Oregon border south to the Transverse Mountains in Los Angeles County, in most of northern California west of the Cascade crest, and along the western flank of the Sierra south to Kern County (CDFG 2005b). Within the study area, this species has been documented at numerous locations in both Alameda Creek and Arroyo Hondo (see Figure 4.4.8, Foothill Yellow-Legged Frog Occurrences and Habitat). Foothill yellow-legged frog is extirpated throughout most of Alameda and Contra Costa counties with surviving populations restricted to several drainages within the Alameda Creek watershed (EBRPD 2007, p. 62).



SOURCE: ETJV unpublished data 2007, CNDDDB 2009a, EBRPD unpublished data.

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.4.8: FOOTHILL YELLOW-LEGGED FROG OCCURRENCES

Foothill yellow-legged frogs occur in perennial rocky streams in a wide range of deciduous and coniferous habitats and are rarely found far from permanent water. Adults rarely move more than about 35 feet but may move up to about 160 feet during periods of high water. During cold weather and other times when activity levels are low, foothill yellow-legged frogs will seek cover under rocks in streams or within a few yards of water. Egg masses are deposited on gravel or rocks in moving water, eggs hatch in about 5 days, and tadpoles transform in 3–4 months (CDFG 2005b). Egg-laying usually occurs after spring flooding and lasts for about 2 weeks (CDFG 2005b).

Foothill yellow-legged frogs spawn in streams in pools within the main channel, runs, glides, or very low-gradient riffles with predominantly cobble, boulder, and gravel substrates. Flow velocities are usually less than 2 feet per second (fps), but in deeper water can range up to 4 fps. Several studies have documented partial scouring above 4.2 fps. Eggs are usually located in open sunny areas with little riparian shading. In rivers, where flow rates would cause scouring, foothill yellow-legged frogs use shallow edgewater areas with low gradients, side channels, pool tail-outs, and side pools on the river margin (Kupferberg 1996, pp. 1336).

In spring of 2006 and 2007, EDAW biologists documented 43 and 27 foothill yellow-legged frog egg masses, respectively, in Arroyo Hondo within the study area (ETJV unpublished data 2007). The species has also been documented in the study area and in several drainages to San Antonio Reservoir, by SFPUC fisheries biologists (SFPUC unpublished data). EBRPD biologists have documented foothill yellow-legged frog breeding in Alameda Creek and have studied their reproduction in the reach from Camp Ohlone to the Sunol Wilderness entrance (EBRPD 2007, p. 35).

Threats to foothill yellow-legged frog include habitat loss and degradation, introduction of exotic predators, and toxic chemicals (e.g., pesticides). Water released from upstream reservoirs during the breeding season can scour egg masses, and decreased flows can force adult frogs to move into permanent pools where they may be more susceptible to predation (Hayes and Jennings 1988 *in* Jones & Stokes 2006).

Since the 1990s, EBRPD biologists have conducted ongoing monitoring and studies of amphibians that breed in Alameda Creek, including foothill yellow-legged frog. This species is of particular focus for study and protection since the Alameda Creek watershed supports the only substantial population within several counties (DiDonato, pers. com.). EBRPD studies indicate that peak foothill yellow-legged frog egg-laying usually occurs sometime in mid-April (EBRPD 2007, p. 35). See the discussion under “California Red-legged Frog” in this section for more detail about timing of reproduction. As with California red-legged frog, it appears that foothill yellow-legged frog can use breeding habitat in creeks that experience some naturally occurring

short-duration high flows but not long-duration high flows such as those resulting from sustained use of the 72-inch cone valve (EBRPD 2007, p. 40).

Foothill yellow-legged frog habitat identified in the project study area includes perennial stream reaches that can support breeding and year-round occupancy and includes all reaches where foothill yellow-legged frogs have been previously documented. Additional potential foothill yellow-legged frog habitat identified in the study area includes stream reaches that may support breeding but do not contain perennial water to support year-round occupancy and reaches with perennial water but where breeding is unlikely due to other factors. The lack of perennial water and presence of abundant shade limits the habitat value of these areas for the foothill yellow-legged frog. As such, these areas are considered impaired breeding habitat for purposes of this EIR.

Habitat for foothill yellow-legged frog includes Arroyo Hondo and most of Alameda Creek above SVWTP. Other potential foothill yellow-legged frog habitat within the primary study area includes the intermittent reach of Alameda Creek upstream of Little Yosemite and Alameda Creek downstream of SVWTP. Calaveras Creek downstream of the dam contains perennial water but is in a narrow, steep canyon, which, combined with riparian vegetation, substantially shades the creek. Substrate in this reach consists largely of bedrock and large boulders with little cobble. Although breeding habitat in this reach is impaired, this reach may be used for other life stages.

Alameda Whipsnake

The Alameda whipsnake is federally and state listed as threatened. It primarily inhabits the inner Coast Range in western and central Contra Costa and Alameda Counties, with additional occurrence records in San Joaquin and Santa Clara Counties (USFWS 2006a, p. 58177). The Alameda whipsnake is typically found in close association with chaparral or scrub stands. These stands serve as the center of home ranges, conceal the snakes from predators, and offer the snakes opportunities to view prey while they forage (USFWS 2006a, p. 58189). The Alameda whipsnake demonstrates a preference for open canopy stands and habitats with woody debris and exposed rock outcrops (USFWS 2006a, p. 58189). Although much of Alameda whipsnake activity occurs in scrub communities, other types of adjacent vegetation are also used for foraging and are necessary for normal behavior, breeding, reproduction, population interaction, and dispersal. Recent studies have shown regular use of a variety of habitats, including oak woodlands, grassland, and riparian areas (Alvarez et al. 2005, pp. 21–24; Swaim 2006), up to 656 feet from scrub or chaparral (USFWS 2005b, p. 60610). Core areas (i.e., areas of concentrated use) used by the snake can be sustained by very small stands of scrub embedded within a larger mosaic of other dominant vegetation types (USFWS 2006a, p. 58189). Swaim has documented Alameda whipsnakes moving through grasslands and woodlands between scrub stands up to approximately 1,000 feet apart (Swaim 2006, p. 58190). Adult snakes appear to have a bimodal seasonal activity pattern with a large peak during the spring mating season and a smaller peak

during late summer and early fall. Although short above-ground movements may occur during the winter, Alameda whipsnakes generally retreat in November into a hibernaculum (shelter used during the snake's dormancy period) and emerge in March (USFWS 2006a).

Two subspecies of the California whipsnake (*Masticophis lateralis*) are recognized: the chaparral whipsnake (*M. l. euryxanthus*) and the Alameda whipsnake (*M. l. lateralis*) (Stebbins 1985, p. 183). The Alameda whipsnake likely historically inhabited chaparral and scrub habitats within Alameda, Contra Costa, and possibly western San Joaquin and northern Santa Clara Counties, but its range has been restricted in this area because of habitat alteration due to urban expansion and land management practices in the last 100 years (USFWS 2002a, p. II-58). The chaparral whipsnake ranges from northern California in the Coast Range and western foothills of the Sierra Nevada to central Baja California (Stebbins 1985, map 132). The extent to which the chaparral whipsnake or individuals with intergrade characteristics exist in areas near the boundaries of the Alameda whipsnake's range is not clear (USFWS 2002a, p. II-58).

Due to fragmentation of the range of the Alameda whipsnake, little or no interchange occurs among populations. The ability of the Alameda whipsnake to interchange between populations near the study area depends on their dispersing along Alameda Creek in Alameda County and crossing under I-680 where the creek passes under the highway (USFWS 1997, p. 64308).

No Alameda whipsnake records have been reported from the primary study area. Several Alameda whipsnake records have been reported from EBRPD lands to the north, west, and east of the study area in Mission Peak Regional Preserve, Camp Ohlone, Sunol Wilderness, and Ohlone Wilderness (USFWS 2002a, p. II-65). One record is from about 1 mile north of Calaveras Dam on SFPUC land north of Alameda Creek, which is managed by EBRPD (DiDonato, pers. com.). Swaim reported a California whipsnake, not identified to subspecies, from "just north of Alameda Creek near the [ACDD]" (LSA 1994). Most of these records are not reported as specific locations and were not mapped (DiDonato, pers. com.); therefore, exhibits prepared for this document do not show occurrence locations. EBRPD treats Alameda whipsnake as widespread throughout the region and assumes their presence wherever suitable habitat (i.e., grassland or scrub with rocky outcrops) occurs (DiDonato, pers. com.). Survey efforts in the area have not been as extensive as those in the other areas of the whipsnake's range because of low development pressure (USFWS 2006a, p. 58195), and no focused surveys have been conducted for Alameda whipsnake for the CDRP or in the vicinity of the study area; therefore, little is known about the population size or movement patterns in the study area.

Habitat within the study area was evaluated for the CDRP and classified for its potential to support Alameda whipsnake populations. Vegetation communities were mapped for the CDRP at a 0.25-acre minimum mapping unit (ETJV 2006a) and included only the study area. Vegetation maps prepared for the draft AWHCP and land cover maps prepared by CDF (CDF 2005) were used to identify scrub habitats adjacent to the study area. The habitat evaluation is based on the

PCEs described in federally designated critical habitat for the Alameda whipsnake:

(1) Scrub/shrub communities with a mosaic of open and closed canopy, (2) woodland or annual grassland plant communities contiguous to lands containing PCE 1, and (3) lands containing rock outcrops, talus, and small mammal burrows within or adjacent to PCEs 1 and/or 2 (USFWS 2006a).

Scrub/Shrub Communities with a Mosaic of Open and Closed Canopy

Scrub/shrub vegetation dominated by low- to medium-stature woody shrubs, with a mosaic of open and closed canopy, occurring at elevations from sea level to approximately 3,850 feet (1,170 meters) is used by the Alameda whipsnake for: shelter from predators, temperature regulation (because it provides sunny and shady locations), prey-viewing opportunities, and nesting habitat and substrate. These features contribute to support a prey base consisting of western fence lizards and other prey species such as skinks, frogs, snakes, and birds. Diablan sage scrub is present throughout the study area, with large concentrations in the vicinity of the dam, especially in areas west and north of the dam that appear to have been disturbed during its construction. Willow riparian forest only occurs in the construction area at the base of the dam and is best characterized as scrub due to the lack of tall, mature willow. For this analysis, scrub/shrub habitat includes all mapped Diablan sage scrub and willow riparian forest but does not include coyote brush scrub. Coyote brush scrub occurs at the south end of the reservoir, is tall, dense, and almost monotypic, and could be used as movement/dispersal habitat. Since this community does not provide the typical forage and cover values of scrub/shrub vegetation in the study area, the frequency of its use by Alameda whipsnake is expected to be low (Swaim 2007) and it is not included in this PCE.

Woodland or Annual Grassland Plant Communities Contiguous to Scrub/Shrub

The mosaic of vegetation in woodland or annual grassland contiguous to scrub is essential to the conservation of the Alameda whipsnake because it supports a prey base consisting of western fence lizards and other prey species such as skinks, frogs, snakes, and birds. It also provides opportunities for: (1) Foraging, by allowing snakes to come in contact with and visualize, track, and capture prey (especially the prey listed above); (2) short- and long-distance dispersal within, between, or to adjacent areas containing essential features; and (3) contact with other Alameda whipsnakes for mating and reproduction. Woodland and grassland habitat includes all vegetated terrestrial habitats in the primary area not already included in PCE 1.

Lands Containing Rock Outcrops, Talus, and Small Mammal Burrows Within or Adjacent to PCEs 1 and/or 2

Rock outcrops, talus, and areas with small mammal burrows are essential to the conservation of the Alameda whipsnake because they are used for retreats (shelter), hibernacula, foraging, and dispersal, and provide additional prey population support functions. Rock outcrops are present in

the study area, mostly near the dam and especially on the hillside to the west and north of the dam where material was quarried for dam construction. Small unmapped rock outcrops and mammal burrows are also present in terrestrial habitats in the study area.

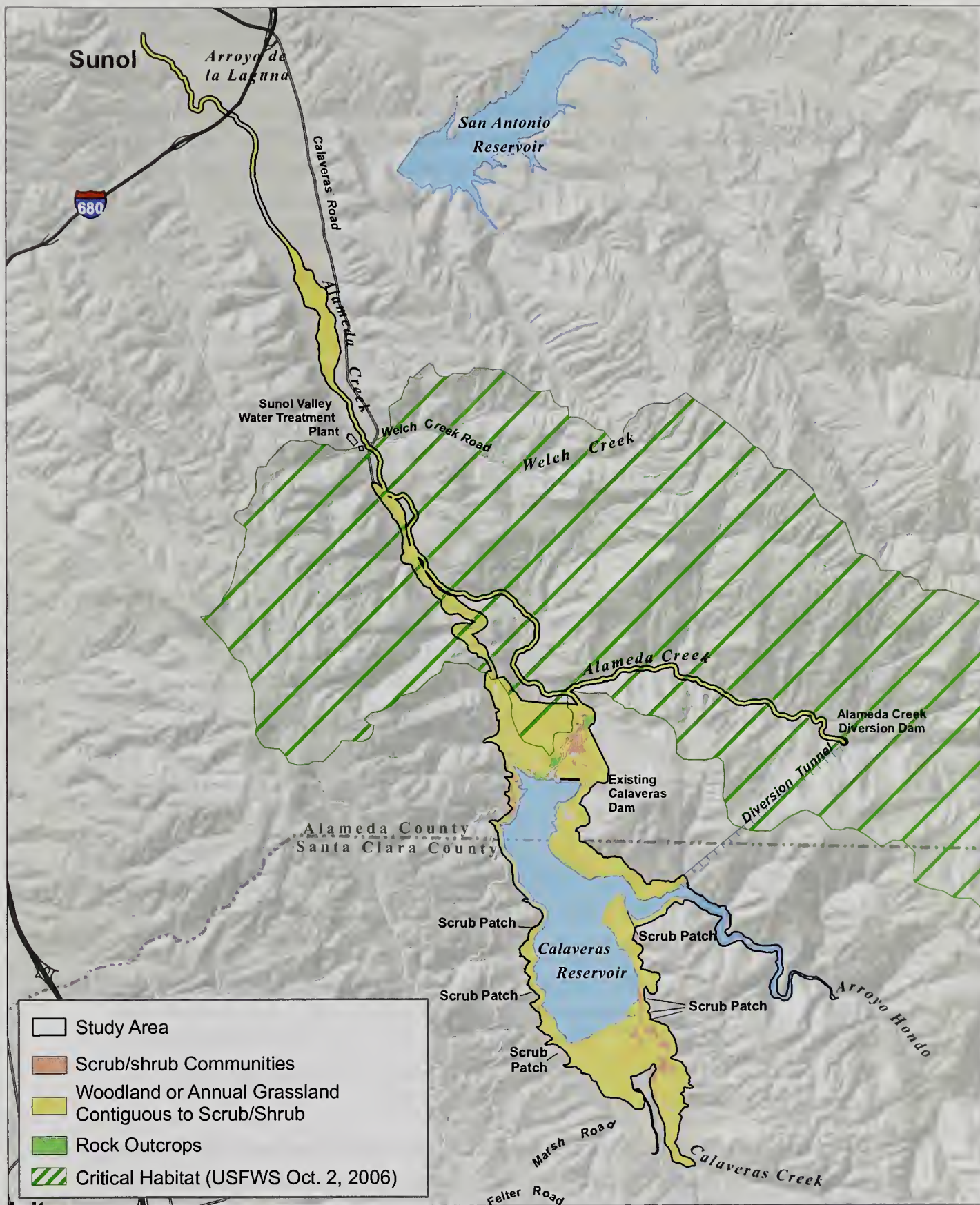
Based on this assessment, the entire study area could be used by Alameda whipsnake for some part of its life cycle, including short- and long-distance movements (see Figure 4.4.9, Alameda Whipsnake Habitat and Critical Habitat, and Table 4.4.6).

Table 4.4.6: Habitat Classification for Alameda Whipsnake in the Calaveras Dam Replacement Project Study Area

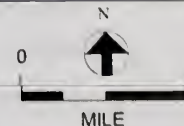
Habitat Element	Definition	Description
Scrub/shrub communities	Scrub/shrub vegetation dominated by low- to medium-stature woody shrubs with a mosaic of open and closed canopy; In the CDRP study area this consists of Diablan sage scrub and willow riparian forest.	Unimpaired
Woodland or annual grassland contiguous to scrub/shrub	Woodland or annual grassland vegetation series supporting a prey base consisting of western fence lizards and other prey species such as skinks, frogs, snakes, and birds, and providing opportunities for: foraging by allowing snakes to come in contact with and visualize, track, and capture prey; short- and long-distance dispersal; and contact with other Alameda whipsnakes for mating and reproduction. In the CDRP study area this consists of all vegetated terrestrial habitats not included in scrub/shrub.	Unimpaired; no substantial barriers to dispersal are present
Rock outcrops, talus, and small mammal burrows	Rock outcrops adjacent to habitat elements described above.	Unimpaired

Source: ETJV unpublished data 2009

Final critical habitat was designated for Alameda whipsnake in October 2006 (USFWS 2006a, p. 58176). The study area is partially located within Unit 5B: Alameda Creek (Alameda and Santa Clara Counties), which is located north of Calaveras Reservoir and south of the town of Sunol and includes the area along Wauhab Ridge in Alameda County and Oak Ridge in Santa Clara County. The unit is included in designated critical habitat because it contains features essential to the conservation of the Alameda whipsnake, is currently occupied by the Alameda whipsnake, represents the southernmost distribution of the Alameda whipsnake, and is one of the five population centers for the subspecies (USFWS 2006a, p. 58195). The study area includes 424 acres of designated critical habitat for the Alameda whipsnake (Figure 4.4.9). USFWS (2006a, p. 58195) identifies the potential need for special management of portions of the unit, such as prescribed burns, to reduce areas of dense vegetation. Other potential special management actions recommended by USFWS throughout this unit include management of: grazing, unauthorized trail and road construction, illegal dumping, feral animals, and control of activities associated with urban or recreational interface (USFWS 2006a, p. 58195).



SOURCE: ETJV unpublished data 2009, URS 2008a.



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.4.9: ALAMEDA WHIPSNAKE HABITAT AND CRITICAL HABITAT

Recovery of the Alameda whipsnake is discussed in the *Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay* (USFWS 2002a, pp. II-77-II-99). The draft recovery plan identifies seven recovery units, based on the five populations and two potential corridors between the populations. The study area is included in Recovery Unit 5 (Sunol-Cedar Mountain Population) and includes portions of Recovery Unit 7 (Niles Canyon-Sunol Corridor).

Recovery Unit 5, the southernmost unit, interfaces between the two subspecies of California whipsnake: the more common chaparral whipsnake and the state and federally listed Alameda whipsnake. Within the EBRPD complex of Sunol, Mission Peak, Ohlone, Camp Ohlone, Del Valle, and the SFPUC Alameda Creek watershed (San Antonio Reservoir), sightings were recorded beginning in the 1970s. These sightings are identified in the CNDDDB as either Alameda whipsnake, closer to Alameda whipsnake, intergrades, or unknown (USFWS 2002a, p. II-65).

The Sunol-Cedar Mountain population is threatened by catastrophic wildfire, mining, and off-road vehicle use. This southern population may have the highest probability of unauthorized collection. Because of its remote roads and abundant assemblage of native reptiles, this area attracts reptile enthusiasts and collectors. The population is threatened to some degree by grazing practices, which may degrade Alameda whipsnake habitats through areas being grazed either too much, or too little, which results in dense vegetation cover (USFWS 2002a, p. II-72).

Bald Eagle

The bald eagle is state listed as endangered and is a Fully Protected species under the California Fish and Game Code. The bald eagle was removed from the federal endangered species list on August 8, 2007; however, it continues to receive federal protection under the federal Bald and Golden Eagle Protection Act. The bald eagle is a raptor typically associated with aquatic ecosystems, frequenting large lakes, rivers, estuaries, reservoirs and coastal habitats. Bald eagles usually nest in large trees along shorelines and use the same breeding territory year after year although they may use alternative nests within the territory.

The bald eagle in California was initially federally listed as endangered in 1978 but was reclassified as threatened in 1995 (USFWS 1995). The USFWS proposed to delist the bald eagle in 1999 and on July 9, 2007, announced the delisting of the bald eagle, which went into effect August 8, 2007 (USFWS 2007). USFWS attributes the recovery of the bald eagle in part to habitat protection and management actions as well as reduction in levels of persistent organochlorine pesticides in the environment (USFWS 2007).

Raptor surveys conducted for the CDRP in April and May 2006 documented a pair of bald eagles nesting on the west shoreline of Calaveras Reservoir. The nest hatched two chicks in late April. One of these chicks died at approximately 4–5 weeks of age and the other at approximately 7–8 weeks old, based on size estimates of the recovered carcasses (Peeters, pers. com.). The Calaveras Reservoir territory includes two nests located approximately 50 feet apart (see Figure

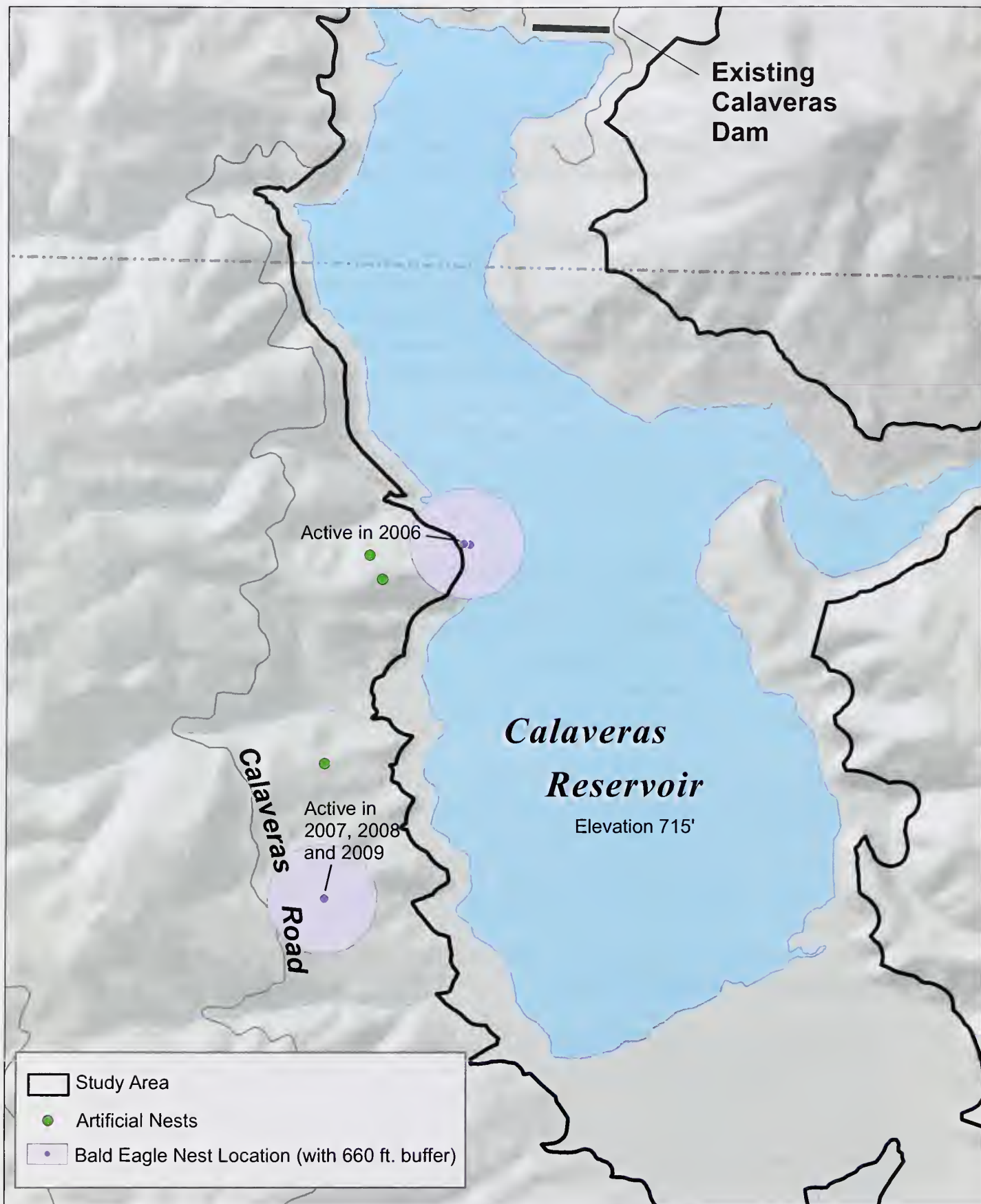
4.4.10, Bald Eagle Nest Locations) in live oak trees within 50-130 feet of the reservoir edge. Based on the size and condition of the nests, they appear to have been used for at least 3 years (Peeters, pers. com.), but there is no conclusive evidence to document how long the territory has been active.

EDAW biologists observed two bald eagles flying over the Calaveras Reservoir territory on December 7, 2006. On January 23, 2007, an EDAW biologist documented a large stick nest on a power transmission tower about 0.9 mile southeast of the known nests (Figure 4.4.10). EDAW received a report of a bald eagle on a stick nest on a transmission tower on February 15, 2007 (Sorenson, pers. com.) and confirmed use of the nest by a pair of bald eagles on February 28, 2007. EDAW biologists checked for bald eagle use of the 2006 nest in February and March 2007 and found no use of the nest during this period. EDAW biologists documented initiation of incubation at the power line nest between March 6 and March 14, 2007. Two chicks were visible and moving within the nest by May 10, 2007 and had left the nest by early July, 2007 (ETJV 2007b).

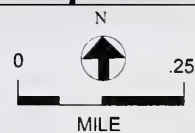
In December 2007, the SFPUC, in consultation with CDFG, installed three artificial bald eagle nest sites between the 2006 and 2007 nests (URS 2008a). These nests are located over 1,000 feet from the proposed west haul route. SFPUC monitored bald eagle breeding at Calaveras Reservoir on a monthly basis through the 2008 breeding season (URS 2008a). The pair nested at the transmission tower in 2008, but apparently the eggs did not hatch and the nest was not successful (Leach, pers. com.). The pair also nested at the transmission tower in 2009.

There are no documented bald eagle nests on Calaveras Reservoir prior to 2006 (Bousman, pers. com.) although there are unconfirmed records of bald eagles nesting there in the late 1970s or early 1980s (Peeters, pers. com.). According to Bousman, surveys conducted in the 1960s by retired CDFG biologist Donald D. McLean did not record bald eagles as present but did report nesting ospreys. Breeding bird surveys conducted on SFPUC land for the Santa Clara Valley Bird Atlas from 1987 to 1993 also did not result in detections of bald eagles on Calaveras Reservoir during the breeding season although the survey area focused on the area south of Arroyo Hondo (Bousman, pers. com.).

During observations of the active nest in the project area in late April and early May 2006, the adult eagles were not seen foraging at Calaveras Reservoir. Instead, during several hours of consecutive observation, EDAW biologists observed them leaving the nest and flying east up the Arroyo Hondo drainage or flying west towards San Francisco Bay. These observations indicate that better quality foraging habitat may be available outside of the proposed work area, but the reason why Calaveras Reservoir, which supports fish and waterfowl populations, may not be used more extensively for foraging by the nesting bald eagles is not clear.



SOURCE: ETJV unpublished data 2007.



Bald eagles also use Calaveras Reservoir during the winter. Although no systematic winter surveys have been conducted (Sorenson, pers. com.), typically one to three individuals have been observed during Christmas Bird Counts (1-day surveys with multiple observers, conducted in December or January) covering the area over the last 40 years (Bousman, pers. com.). Past radio-tracking of bald eagles from 1986 to 1994 has shown that released birds from the Big Sur coast have passed through the study area but have not lingered at Calaveras Reservoir for any significant amount of time (Sorenson, pers. com.).

The Pacific Bald Eagle Recovery Plan was prepared in 1986 and established several goals, including (1) a goal to have a minimum of 800 nesting pairs in the region, (2) a goal for annual productivity of 1.0 fledged young per occupied breeding area with an average success rate of not less than 65 percent over a 5-year period, (3) specific breeding population goals that should be met in at least 80 percent of the management zones that have nesting potential, and (4) a goal for the wintering population to be stable or increasing (USFWS 1986). According to USFWS (2006b), the overall recovery goals for the Pacific Region have been met: the number of nesting pairs exceeded the recovery goal of 800 in 1990 and has continued to increase; productivity has averaged one young per nesting pair since 1990; in 1998, six of the seven states in the Pacific Region reported an average success rate of 75 percent; distribution of nesting pairs among management zones was achieved in 1999; and wintering populations are stable or increasing on average for the region, with Washington, Oregon, Idaho, and California experiencing an increasing trend in wintering populations of 1.5 to 4.5 percent.

The study area for the CDRP is within the Central California Coast management zone established by the Pacific Bald Eagle Recovery Plan (USFWS 1986). This zone achieved its recovery targets in 1999 before the discovery of the nesting pair at the Calaveras Reservoir (USFWS 2006d). In 2006, over a dozen bald eagle territories were reported and over 20 young were fledged in the Central California Coast management zone (Sorenson, pers. com.).

Although the bald eagle has been delisted, it is still protected by other federal and state laws. To provide guidance to land managers, landowners, and others, USFWS has developed draft *National Bald Eagle Management Guidelines* (USFWS 2006e). The guidelines discuss the sensitivity of bald eagles during stages of their breeding chronology. Table 4.4.7 summarizes the sensitivity of bald eagles to disturbance and presents the chronology of typical breeding in California (USFWS 2006e).

Table 4.4.7: Nesting Bald Eagle Sensitivity to Human Activities

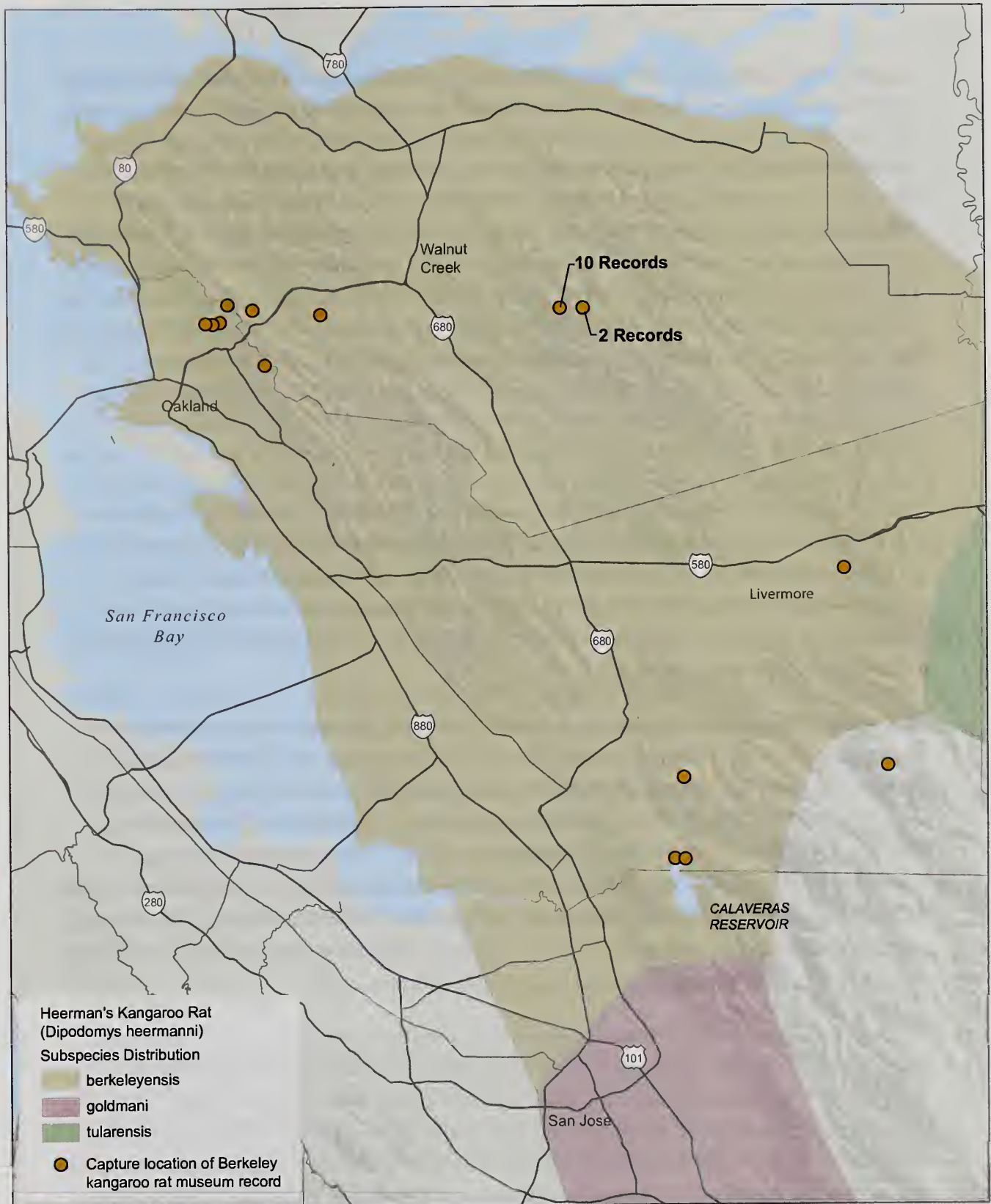
Activity	Typical Timing for California Populations	Sensitivity to Human Activities	Comments
Courtship and nest building	January through March	Most sensitive period; likely to respond negatively	Most critical time period; disturbance is manifested in nest abandonment. Bald eagles in newly established territories are more prone to abandon nest sites.
Egg laying	February through March	Very sensitive period	Human activity of even limited duration may cause nest desertion and abandonment of territory for the nesting season.
Incubation and hatching	March through June	Very sensitive period	Adults are less likely to abandon the nest near and after hatching. However, flushed adults leave eggs and young unattended; eggs are susceptible to cooling, loss of moisture, overheating, and predation; young are vulnerable to elements.
Nesting period	June through August	Moderately sensitive period	Likelihood of nest abandonment and vulnerability of the young to elements gradually decreases. However, nestlings may miss feedings, which may affect their survival, or may prematurely leave the nest due to disruption, resulting in their death.

Source: USFWS 2006e

Berkeley Kangaroo Rat

Neither the CDFG nor the USFWS has formally designated the Berkeley kangaroo rat (*Dipodomys heermanni berkeleyensis*) as threatened or endangered under CESA or ESA. Berkeley kangaroo rat was considered for classification as a California species of special concern (Williams 1986) but was not designated as such. Therefore, it has no official state or federal listing. However, Berkeley kangaroo rat is considered by the CNDDDB to be vulnerable to extinction due to its remaining population size and range (CNDDDB 2009b). Therefore, for the purpose of this analysis, it is considered rare as defined under CEQA Guidelines Section 15380.

The Berkeley kangaroo rat was first described as a subspecies of Heermann's kangaroo rat (*Dipodomys heermanni*) in 1922 (Grinnell 1919, 1922). Few studies have been conducted since then, and its taxonomy and distribution need clarifying (Williams 1986, USFWS 2002a). Current classification of the Berkeley kangaroo rat is based on the comparative morphology of relatively few specimens collected from Berkeley and Oakland east to Mount Diablo (Grinnell 1922, Hooper 1936) (see Figure 4.4.11, Berkeley Kangaroo Rat Historic Locations and Subspecies Range). Many species and subspecies classifications within the genus *Dipodomys* are based on degree of morphological "specialization," comparing characteristics such as teeth, limb and tail proportions, ear bone shape, and visceral organ symmetry (Johnson and Selander 1971). Classifications based on morphometrics have, at times, been in disagreement with those based on biochemical data (Patton and Rogers 1993). Hence, many taxonomic relationships within the genus have so far been unresolved.



As with the taxonomy, the distribution of the Berkeley kangaroo rat has not been clearly defined. When the subspecies was first described by Grinnell, he predicted its distribution would include the “Mount Diablo range and adjacent hills to the east of San Francisco” and presented a map which indicated its range extended south to the vicinity of San Jose (Grinnell 1919, 1922). In December 1939 and July 1940, two Berkeley kangaroo rats were captured in the vicinity of Calaveras Reservoir and Dam; these were classified based only on capture location. Subsequent identification of captured Berkeley kangaroo rats has also been based on capture location and the range map developed by Grinnell (ETJV 2007a). Little has been learned about the distribution of the Berkeley kangaroo rat since the 1940s, and no comprehensive surveys have been conducted to verify its range. There is enough uncertainty about the range of the Berkeley kangaroo rat that CDFG will not accept new records of the subspecies without confirmation by genetic analysis (CDFG 2006).

To date, no conclusive genetic analyses have been conducted on samples of Berkeley kangaroo rats (CDFG 2006). A major impediment to genetic analysis is locating molecular markers that can be used to distinguish Berkeley kangaroo rat from its closest neighbors, *D. h. tularensis* and *D. h. goldmani* (Patton pers. com.) (Figure 4.4.11). Furthermore, genetic material is only available from a very small number of *D. h. berkeleyensis*, and genetic material for *D. h. tularensis* and *D. h. goldmani* is lacking in the portions of their ranges adjacent to the range of *D. h. berkeleyensis* (Patton, pers. com.).

The Berkeley kangaroo rat had not been reported for decades prior to 2000, and USFWS presumed it was extinct (USFWS 2002a, p. II-47). However, since 2000, three Heermann’s kangaroo rats have been collected by EBRPD biologists in the Sunol and Ohlone Wilderness areas (ETJV 2007a). One of these kangaroo rats, live-trapped in April 2000, was taken to UC Berkeley for identification. It was confirmed as the species *D. heermanni* but subspecies identification was nearly impossible given only one specimen and a capture location very near the known range of *D. h. goldmani* (Patton, pers. com.) In 2006, EBRPD staff sent several tissue samples from Heermann’s kangaroo rats to UC Berkeley for genetic analysis. Preliminary results were inconclusive regarding subspecies status (DiDonato, pers. com.).

Habitat information for the Berkeley kangaroo rat has not been well documented. Field notes associated with museum specimens describe their habitat as bare ridges near rocky outcrops and on thin soils with scattered chaparral species and small annual grasses (USFWS 2002a, p. II-50), and the subspecies has been described using open, grassy hilltops and open spaces in chaparral and blue oak/foothill pine woodlands (Williams 1986, p. 83). Additional habitat associations are assumed from descriptions of Heermann’s kangaroo rat habitat use. Heermann’s kangaroo rats generally avoid heavily vegetated habitats (e.g., woodlands), areas with tall grass or thick chaparral, and steep rocky slopes; rather, they are usually found on knolls and ridges where there is minimal vegetation and bare soil that is shallow and well drained (Tappe 1941, pp. 122–123;

Quast 1954, pp. 520–521). Open ground is important for predator detection and escape routes to burrows (Tappe 1941, pp. 121–122); hence, burrow sites often occur on open areas.

EDAW biologists used aerial photography, vegetation mapping, and reconnaissance surveys to identify areas within the study area that could support Heermann's kangaroo rats. They subsequently conducted daytime and nighttime surveys for kangaroo rats within and near the study area. No Heermann's kangaroo rats were detected, and no burrows with characteristic Heermann's kangaroo rat signs were found. However, many burrows of suitable size for Berkeley kangaroo rat were present, and EBRPD biologists have found Heermann's kangaroo rats using gopher burrows in the Sunol and Ohlone Wilderness areas (DiDonato, pers. com.). Several recent incidental Heermann's kangaroo rat records from EBRPD lands to the north of the CDRP are of animals captured in moderate to heavily grazed grasslands after having been initially detected on or near roads with vehicle lights on moonless nights (DiDonato, pers. com.).

Factors contributing to the decline of the Berkeley kangaroo rat are not specifically known. Likely causes include urbanization, habitat destruction or degradation, and rodent poisoning programs (USFWS 2002a, p. II-50). Relatively large areas of potential habitat remain within the subspecies mapped range, including knolls and ridges in grazed grasslands on SFPUC and EBRPD lands (Figure 4.4.2).

EDAW implemented a focused habitat assessment, visual surveys, and trapping efforts for the Berkeley kangaroo rat in September 2007, using methods consistent with the CDFG survey protocol (CDFG 2006). Traps were set both in areas with burrows where possible kangaroo rat signs were identified during daytime surveys and at other locations in an attempt to trap dispersing or transient individuals. In eight nights of trapping, using 53 traps per night, only mice from the genus *Peromyscus* were captured on seven occasions in non-native grasslands of the northern section of the CDRP study area. No kangaroo rats were captured during the trapping program (ETJV 2007b). Since no kangaroo rats were detected, Berkeley kangaroo rat is assumed to not occur in the primary study area.

Western Pond Turtle

The western pond turtle is a California species of special concern that occurs in rivers, streams, lakes, ponds, wetlands, reservoirs, and brackish estuarine waters. It mostly uses aquatic habitats for foraging, thermoregulation, and avoidance of predators, and prefers areas with basking sites and cover. The western pond turtle overwinters in both aquatic and terrestrial habitats and nests in warm, exposed upland habitats.

In the primary study area, habitat for the western pond turtle includes Calaveras Creek downstream of the dam, Alameda Creek, Arroyo Hondo, and Calaveras Reservoir. Western pond

turtles were regularly observed in stock ponds, creeks, and on the banks of Calaveras Reservoir during field studies in 2006 and 2007 for the CDRP.

Nesting Raptors

Common and special-status tree-nesting raptor species are known to breed in or near the CDRP study area, including red-tailed hawk, white-tailed kite, bald eagle (described earlier in this section), and golden eagle. Osprey, and long-eared owl are special-status raptors that could breed in the study area but have not yet been documented nesting there. White-tailed kite and golden eagle are fully protected species in California. White-tailed kite nests in moderately tall trees (15 to 75 feet) and forages in open meadows, grasslands, and agricultural fields. Golden eagle is a locally common but widely distributed breeder in the CDRP region. It nests in large trees, on shelves, cliffs, or embankments and forages in open grasslands and agricultural areas.

Osprey and long-eared owl are also California species of special concern that could breed in the study area. Ospreys require clear water for foraging and large trees and snags for nesting and perching. Long-eared owls nest in dense riparian and oak woodlands.

Cliff-Nesting Raptors

American peregrine falcon and prairie falcon are special-status raptors that nest on cliffs in the region of the CDRP. There is potentially suitable habitat for these species in the vicinity of the dam. American peregrine falcon is a federally delisted species; however, it is a California endangered species and is fully protected in California. This species forages over a variety of habitats where aerial prey is present. It nests on cliffs or ledges. Prairie falcons forage over grasslands and other open areas and also nests on cliffs or ledges. Both species have been documented nesting on EBRP land north of Calaveras Reservoir but not in the study area.

Ground-Nesting Raptors

Burrowing owl and northern harrier are special-status ground-nesting raptors that could occur in the CDRP study area. Burrowing owl is a California species of special concern that requires open, dry grasslands, or agricultural areas with available burrows. Burrows suitable for use by this species are present in the study area; however, these species are uncommon breeders in the region, and there is a low likelihood that they would nest in the project area. Northern harrier is a California species of concern that forages in marshes, moist grasslands, and meadows and nests on the ground in grassy or vegetated areas that are usually well concealed. It was not documented nesting during several years of raptor nest surveys conducted for this project in the study area.

Upland Species of Concern

There are seven upland species of concern found in the CDRP study area: three birds and four mammals. Bird species are loggerhead shrike, grasshopper sparrow, and tricolored blackbird. Mammal species are American badger, Townsend's big-eared bat, pallid bat, and western mastiff bat. There is suitable habitat for these species in the study area.

Loggerhead Shrike

The loggerhead shrike is a California species of special concern that could occur in the study area. It requires grasslands, open woodlands, and agricultural areas with scattered shrubs. The loggerhead shrike uses open landscapes characterized by well-spaced, often spiny, shrubs and low trees for nesting and foraging. It also favors fence lines and utility lines and poles for perching and is frequently conspicuous along roadways. This species is rarely present in the vicinity of the CDRP and was not documented breeding in the study area during spring 2006 surveys.

Grasshopper Sparrow

Grasshopper sparrow is a California species of special concern that occurs in the study area. It requires short to moderate height grasslands that are usually open with scattered shrubs. Grasshopper sparrow forages on the ground or from low vegetation. Its diet is composed mostly of grasshoppers and seeds. Grasshopper sparrow was documented in the study area during breeding season surveys.

Tricolored Blackbird

Tricolored blackbird is a California species of special concern that could occur in the study area but is not expected to breed there. It requires protected nesting substrate (dense freshwater marsh or riparian vegetation including flooded, thorny, or spiny vegetation) with access to insect prey. Breeding individuals forage away from their nest sites, often well out of sight of the colony. Most forage in close proximity to colony sites but may commute over 2 miles to forage. The tricolored blackbird was recorded in the Sunol Valley in April 1994 (CNDDDB 2009a). Patches of suitable habitat exist in the study area, but they are too small to likely be used. Tricolored blackbird was not documented in study area during 2006 breeding season surveys.

American Badger

American badger is a California species of special concern that could occur in the study area. It requires dry open grassland, shrub, and forest habitats with friable soils. It is an efficient digger with very large claws. It sleeps through most of the winter but becomes active on warmer days. It hunts ground squirrels and other small- and medium-sized prey. American badger occurs in the region and suitable habitat is present in the study area.

Townsend's Big-Eared Bat

Townsend's big-eared bat is a California species of special concern that could occur in the study area. This migratory bat roosts in caves, mines, and cavernous building spaces (large attics) in moist habitats. Maternity roosts can be quite large, with hundreds of individuals. This bat forages late at night, which makes it difficult to observe in flight. It often hunts in edge habitats between forest and open areas. One individual was documented at Calaveras Dam in 1997 (CNDDDB 2009a).

Pallid Bat

The pallid bat is a California species of special concern that could occur in the study area. It is a permanent resident within its range. It requires crevices in rocks, caves, mine, trees, hollows, buildings, bridges, and often trees in oak woodlands. Maternity roosts can be quite large, with hundreds of individuals. It occurs in the region, and suitable habitat is present in the study area.

Western Mastiff Bat

The western mastiff bat is a California species of special concern that could occur in the study area. It is a permanent resident within its range. It roosts in crevices on cliff faces, boulders, and buildings, usually with space for at least a 10-foot vertical drop. Communal roosts typically consist of 30-100 individuals but can be larger. It occurs in the region, and suitable habitat is present in the study area.

Special-Status Plant and Wildlife Species in the Extended Study Area

Several of the resources identified above may also occur in the aquatic environment of the extended study area. California red-legged frogs and western pond turtles have been documented in the Niles Canyon reach (CNDDDB 2009a) of Alameda Creek. California red-legged frogs may breed in pools and other areas of slow-moving, relatively deep water. Foothill yellow-legged frogs have not been documented in Niles Canyon but may occur there and could breed in cobble- or boulder-dominated riffles, glides, and pools. There is a relatively well-developed riparian zone throughout Niles Canyon, which could be used by the silvery legless lizard, California horned lizard, birds protected by the Migratory Bird Treaty Act (MBTA), Townsend's big-eared bat, pallid bat, and western mastiff bat; these species habitat associations are described in Appendix C.1.

4.4.1.3 REGULATORY FRAMEWORK

Subsection 4.4.1.3 Contents

Federal Regulations

- Federal Endangered Species Act
 - Critical Habitat
 - Recovery Plans
- Migratory Bird Treaty Act
- Bald and Golden Eagle Protection Act
- Section 404 of the Clean Water Act
- Section 401 of the Clean Water Act

State Regulations

- Porter-Cologne Water Quality Control Act
- California Endangered Species Act
- California Fish and Game Code
 - Section 5050
 - Section 1602
 - Section 3503-3503.5
 - Section 1900-1913

Local and Regional Regulations

- Alameda County
 - Municipal Code
 - General Plan
- Santa Clara County
 - Ordinance Code
 - General Plan
- Alameda Watershed Management Plan
- SFPUC Water Enterprise Environmental Stewardship Policy

Federal Regulations

Federal Endangered Species Act

Pursuant to FESA of 1973 (16 U.S. Code [USC] 1531 *et seq.*), as amended, USFWS has regulatory authority over federally listed species. Under FESA, a permit to “take” a listed species is required for any federal action that may harm an individual of that species. “Take” is defined under Section 9 of FESA as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct.” Under federal regulation, “take” is further defined to include habitat modification or degradation where it would be expected to result in death or injury to listed wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. In addition to listed species, the USFWS publishes a list of candidate species for which it has sufficient biological information to support a proposal to list as endangered or threatened. Species on this list are not protected under FESA, but they receive special attention during environmental review.

Section 7 of FESA requires all federal agencies to consult with USFWS to ensure that their actions are not likely to “jeopardize the continued existence” of any listed species or “result in the destruction or adverse modification” of designated critical habitat. Because implementation of the proposed project would result in the fill of USACE jurisdictional waters, consultation between USACE and USFWS under Section 7 of FESA will be required for the callippe silverspot butterfly, California red-legged frog, California tiger salamander, and Alameda whipsnake. Section 7 of FESA allows USFWS to issue a Biological Opinion authorizing the incidental take of listed species if such take is accompanied by measures to minimize and mitigate impacts associated with the take. A Biological Assessment (used for formal Section 7 consultations) is being prepared concurrently with this EIR.

Critical Habitat

Pursuant to FESA, USFWS must officially designate critical habitat for a species when it becomes listed under FESA. Critical habitat is defined as specific areas that are essential to the conservation of a federally listed species and that may require special management considerations or protection. Critical habitat is determined using the best available scientific information about the physical and biological needs, or “primary constituent elements” (PCEs), of the species. Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to result in habitat destruction or adverse modification of the designated areas. Critical habitat has been designated in the study area for California tiger salamander and Alameda whipsnake. These designations are discussed in more detail in the species descriptions in this section.

Recovery Plans

FESA directs the Secretary of the Interior and the Secretary of Commerce to develop and implement recovery plans for species of animals and plants listed as endangered or threatened. A recovery plan delineates, justifies, and schedules the research and management actions necessary to support recovery of a species, including those that, if successfully undertaken, are likely to permit reclassification or delisting of the species. The USFWS is responsible for preparing recovery plans for birds and terrestrial and freshwater species. Recovery plans have been released in final or draft form for two federally listed species that could be affected by the project: Alameda whipsnake and California red-legged frog. Recovery plans are discussed in more detail in the species descriptions in this section.

Migratory Bird Treaty Act

The MBTA, first enacted in 1918, implements domestically a series of treaties between the United States and Great Britain (on behalf of Canada), Mexico, Japan, and the former Soviet Union that provide for international migratory bird protection. The MBTA authorizes the Secretary of the Interior to regulate the taking of migratory birds; the act provides that it shall be

unlawful, except as permitted by regulations, “to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird...” (USC Title 16, Section 703). This prohibition includes both direct and indirect acts although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. The current list of species protected by the MBTA includes several hundred species and essentially includes all native birds. Migratory birds are found in the study area.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from “taking” bald eagles, including their parts, nests, or eggs. The act provides criminal penalties for persons who “take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof.” The act defines “take” as “pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb.” USFWS has defined “disturb” to mean “to agitate or bother a bald or golden eagle to the degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, causing injury, death, or nest abandonment.” In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle’s return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment. On June 5, 2007, in anticipation of removing the bald eagle from the federal endangered species list, the USFWS published a proposed rule for a new permit that would authorize limited take under the Bald and Golden Eagle Protection Act. Bald eagles nested within 100 feet of the study area in 2006 and over 1,000 feet from the study area in 2007 and 2008. Golden eagles nest in the vicinity of Calaveras Reservoir but have not been recorded in the study area (Bell, pers. com.).

Section 404 of the Clean Water Act

Section 404 of the federal CWA (33 USC 1344) authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue Department of the Army (DA) permits, after notice and opportunity for public hearing, for the discharge of dredged or fill material into the waters of the United States. “Fill material” means material placed in waters of the United States where the material has the effect of replacing any portion of a water of the United States with dry land or changing the bottom elevation of any portion of a water of the United States. Examples of fill material include, but are not limited to, rock, sand, soil, clay, plastics, construction debris, wood chips, overburden from mining or other excavation activities, and material used to create any structure or infrastructure in waters of the United States. Waters of the United States include

navigable waters of the United States; interstate waters; all other waters where the use, degradation, or destruction of the waters could affect interstate or foreign commerce; tributaries to any of these waters; and wetlands that meet any of these criteria or that are adjacent to any of these waters or their tributaries. Wetlands are defined as those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Jurisdictional wetlands must meet three wetland delineation criteria: hydrophytic vegetation, hydric soil types, and wetland hydrology. Many surface waters and wetlands in California meet the criteria for waters of the United States, including intermittent streams and seasonal lakes and wetlands. Jurisdictional waters of the United States in the study area include wetlands, ponds, Calaveras Reservoir, Arroyo Hondo, Calaveras and Alameda Creeks, and several small unnamed channels.

The USACE has determined that the CDRP would require a DA individual permit. The Code of Federal Regulations (CFR) Title 33, Sections 300-330 prescribes those special policies, practices, and procedures to be followed by the USACE in connection with the review of applications for DA permits to authorize the discharge of dredged or fill material into waters of the United States. The decision whether to issue a DA permit is based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Evaluation of the probable impacts that the proposed activity may have on the public interest requires a careful weighing of all factors that become relevant in each particular case. The benefits that reasonably may be expected to accrue from a proposal must be balanced against its reasonably foreseeable detriments. The decision whether to authorize a proposal, and if so, the conditions under which it would be allowed to occur, is determined by the outcome of this general balancing process. The decision by the USACE will reflect the national concern for both protection and utilization of important resources.

Applications for DA permits will be denied if the discharge that would be authorized by the permit would not comply with the CWA Section 404(b) (1) Guidelines (CFR, Title 40, Section 230.10[a]). The Guidelines state that “no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences.” Practicable alternatives include, but are not limited to: (1) Activities that do not involve a discharge of dredged or fill material into the waters of the United States or ocean waters; (2) Discharges of dredged or fill material at other locations in waters of the United States or ocean waters.

Applications for DA permits for activities that may adversely affect the quality of waters of the United States must be evaluated for compliance with applicable effluent limitations and water quality standards during the construction and subsequent operation of the proposed activity.

Certification of compliance with applicable effluent limitations and water quality standards required under provisions of Section 401 of the Clean Water Act will be considered conclusive with respect to water quality considerations.

Section 401 of the Clean Water Act

CWA Section 401(a)(1) specifies that any applicant for a federal license or permit to conduct any activity that may result in any discharge into navigable waters shall provide the federal licensing or permitting agency with a certification that any such discharge will not violate state water quality standards. The RWQCBs administer the Section 401 program with the intent of prescribing measures for projects to avoid, minimize, and mitigate adverse impacts on water quality and ecosystems. The CDRP would require a Section 401 permit.

State Regulations

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act provides the basis for water quality regulation within California (see Section 4.7, Water Quality, for additional information). This act allows the State Water Resources Control Board (SWRCB) to adopt statewide water quality control plans or basin plans. The purpose of the plans is to establish water quality objectives for specific water bodies. Most of the implementation of SWRCB's responsibilities is delegated to the nine regional boards. The San Francisco Bay RWQCB has prepared the *San Francisco Bay Basin Plan* that establishes water quality objectives and implementation programs to meet the stated objectives and to protect the beneficial uses of bay waters.

Under the Porter-Cologne Water Quality Control Act, wetlands and drainages that are considered waters of the United States by the USACE are often classified as waters of the state as well. However, waters of the state can also include waters USACE deems to be isolated or non-jurisdictional under Section 404 of the CWA. Impacts on waters of the state typically require mitigation requiring no net loss of wetlands functions and values of waters of the state.

California Endangered Species Act

CESA directs state agencies not to approve projects that would jeopardize the continued existence of an endangered or threatened species or result in the destruction or adverse modification of habitat essential to the continued existence of a species. Furthermore, CESA states that reasonable and prudent alternatives shall be developed by CDFG, together with the project proponent and any state lead agency, consistent with conserving the species, while at the same time maintaining the project purpose to the greatest extent possible. A "take" of a species, under CESA, is defined as an activity that would directly or indirectly kill an individual of a species. The CESA definition of take does not include "harm" or "harass" as is included in FESA. As a

result, the threshold for a take under CESA may be higher than under FESA because habitat modification is not necessarily considered take under CESA.

Sections 2081(b) and (c) of CESA allow CDFG to issue an incidental take permit for a state-listed threatened and endangered species only if the following specific criteria are met: (1) that take is incidental to an otherwise lawful activity, (2) that the impacts of the authorized take have been minimized and fully mitigated, (3) that the permit is consistent with regulations adopted pursuant to Sections 2112 and 2114, (4) that the applicant has ensured adequate funding to implement minimization and mitigation measures and monitor these measures for compliance and effectiveness, and (5) that issuance of the permit will not jeopardize the continued existence of a state-listed species.

Should the project applicant receive authorization to take federally listed species under FESA, take authorization may also be sought as a “consistency determination” from CDFG under Section 2080.1 of CESA. If CDFG determines that the federal statement/permit is not consistent with CESA, the applicant must apply for a state incidental take permit under section 2081(b) of the Fish and Game Code.

The potential for the project to adversely affect a state-listed threatened species (e.g., Alameda whipsnake) would necessitate consultation with CDFG pursuant to CESA.

California Fish and Game Code

Section 5050

Section 5050 of the California Fish and Game Code strictly prohibits the incidental or deliberate take of fully protected species. CDFG cannot issue a take permit for fully protected species, except under narrow conditions for scientific research or the protection of livestock; therefore, avoidance measures may be required to avoid a take. Fully protected species known or expected to occur in the study area include bald eagle, golden eagle, American peregrine falcon, and white-tailed kite.

Section 1602

Rivers, streams, and lakes in California are subject to regulation by CDFG, pursuant to Section 1602 of the California Fish and Game Code. Activities regulated by CDFG include diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake. Section 1602 states that it is unlawful for any person to substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by CDFG, or use any material from the streambed, without first notifying CDFG of such activity. CDFG defines a stream as a body of water that flows at least periodically or intermittently through a bed or channel having banks and that supports fish or other aquatic life.

Section 3503-3503.5

Section 3503 of the California Fish and Game Code states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Section 3503.5 of the Fish and Game Code specifically states that it is unlawful to take, possess, or destroy any raptors (e.g., hawks, owls, eagles, and falcons), including their nests or eggs.

Section 1900-1913

These sections of the California Fish and Game Code codify the Native Plant Protection Act, which is intended to preserve, protect, and enhance endangered or rare native plants in the state. The act directs CDFG to establish criteria for determining what native plants are rare or endangered. Under Section 1901, a species is endangered when its prospects for survival and reproduction are in immediate jeopardy from one or more causes. A species is rare when, although not threatened with immediate extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens. Under the act, the Fish and Game Commission may adopt regulations governing the taking, possessing, propagation, or sale of any endangered or rare native plant.

Local and Regional Regulations

The City and County of San Francisco (CCSF), as a chartered city and county, and the SFPUC, as a public utility, both receive intergovernmental immunity (California Government Code Sections 53090 *et seq.*) from the planning and building laws of any other city or county in which those lands are located. The SFPUC is required under California Government Code Section 65402(b) to inform local governments of its plans to construct projects or acquire or dispose of its extraterritorial property. Local governments have a 40-day review period to determine project consistency with their general plans. Under this requirement, the cities' or counties' determinations of consistency are advisory to the SFPUC rather than binding.

The SFPUC seeks to work cooperatively with local jurisdictions to avoid conflicts with local land use plans and building and zoning codes. Relevant goals, policies, and implementation actions contained in the general plans of other cities and counties within the study area may provide guidance within the context of CEQA as to the compatibility of the CDRP with the environmental conservation and mitigation goals and policies of Alameda and Santa Clara Counties.

County general plans usually contain provisions to maintain parks and open space and to protect valued biological resources such as wetlands. Many of the biological resources protected by local policies and ordinances, such as wetlands, are also protected under state and federal laws and regulations. Tree protection ordinances adopted by Alameda and Santa Clara Counties are described below, as are relevant General Plan policies.

Alameda County

Municipal Code

Alameda County Municipal Code (amended through January 2009), Title 12, Public Roadways and Parks, Chapter 12.11, Regulation of Trees in County Right of Way, states that planting, maintaining, or removing any protected tree from the county right-of-way and all associated facilities is subject to the permitting requirements of the county. Protected trees include, but are not limited to, any woody perennial plant characterized by having a single trunk or multi-trunk structure at least 10 feet high and having a major trunk that is at least two inches in diameter at 4.5 feet from the ground.

General Plan

Land use planning for eastern Alameda County is governed by the *East County Area Plan* (ECAP) of the *Alameda County General Plan*. Alameda County and the ECAP have planning jurisdiction only to the extent that proposed projects are required to locate work sites away from large stands of mature, healthy trees as well as individual healthy trees of notable size and age. Where this is not possible and trees are subject to removal, the county requires that a tree replacement program be developed and implemented. The ECAP further states, under Policies 127 and 129, that the county encourages the preservation of East County's oak woodland plant communities and the preservation of riparian woodland habitat along Alameda Creek.

Santa Clara County

Ordinance Code

Santa Clara County Ordinance Code (amended through January 13, 2009), Title C, Construction, Development and Land Use, Division C16, Tree Preservation and Removal, states that planting, maintaining, or removing any protected tree from the county right-of-way and all associated facilities is subject to the permitting requirements of the county. Protected trees include, but are not limited to, trees having a main trunk or stem measuring 37.7 inches or greater in circumference (12 inches or more in diameter) at a height of 4.5 feet above ground level, or which exceed 20 feet in height on any property owned or leased by the county; heritage trees recognized by the County Board of Supervisors; and any tree, regardless of size, located within road rights-of-way and easements.

General Plan

Santa Clara County General Plan Book B focuses on the rural unincorporated portions of Santa Clara County. It contains strategies and policies intended to protect the natural environment and balance these needs with urban growth and the demand for recreation in parks and open spaces.

Under the Resource Conservation chapter of the *General Plan*, the protection of different habitat types, such as bayland habitats and chaparral, woodland, and forest habitats, is emphasized as an important strategy for protecting and promoting biological integrity without an overly specific focus on individual species protections (see, for example, Policies R-RC-19, RC-21, RC-23, RC-24, RC-31, and RC-51.) This approach supports federal and state regulatory efforts to protect individual species as well as crucial habitat types such as wetlands. The county also focuses on the protection of healthy, mature specimen trees (see Policy R-RC 44 of the *General Plan*) and the protection of heritage trees that are unique and irreplaceable. Protection of heritage trees is regulated by Title C, Division C16 of the county's Ordinance Code. The *General Plan* for the rural, unincorporated areas of Santa Clara County promotes various strategies and policies aimed at striking a balance between the multiple uses of public lands, the development of private lands in rural areas, and resource conservation and management efforts focused on habitat protection of crucial habitats rather than preservation of individual species.

Alameda Watershed Management Plan

The SFPUC's mission for managing the Peninsula and Alameda Creek watersheds is to provide the best environment for the production, collection, and storage of the highest quality water for CCSF and suburban customers. The Alameda Creek watershed is a major contributor to the SFPUC water delivery system serving 2.4 million Bay Area customers. As such, the primary watershed goal of the SFPUC is to maintain and improve source water quality to protect public health and safety. Secondary goals include the maximization of water supply and the preservation and enhancement of ecological resources. The SFPUC developed, and is currently implementing, the *Alameda Watershed Management Plan* (SFPUC 2001), which provides the SFPUC with a policy framework that it uses to make consistent decisions about the activities, practices, and procedures that are appropriate on SFPUC watershed lands. To aid the SFPUC in its decision-making, the plan provides a comprehensive set of goals, policies, and management actions that integrate all watershed resources.

The following policies are particularly applicable to CDRP as related to Vegetation and Wildlife:

- Action veg3 (Phase A) Prior to the initiation of any watershed activity that may affect an Ecological Sensitivity Zone (ESZ), conduct surveys for special-status species and map observed occurrences in the GIS database. Update ESZ mapping based on surveys. Develop and implement effective mitigation measures to avoid and minimize adverse effects on species and their natural communities.
- Action veg6.1 (Phase 2) Identify stands of exotic trees that serve as important roosting and nesting sites for various raptors and other birds protected by CDFG Code 3503. Work with appropriate agencies to preserve core habitat.
- Action wil2 (Phase A) Conduct comprehensive (if broad-based activity) or site-specific surveys of affected habitats to more completely determine the presence or absence of listed or sensitive taxa. When making decisions related to watershed activities that may

affect a high ESZ, develop and implement effective mitigation measures to avoid and minimize adverse effects on species and habitat.

- Action wil3 (Phase 3) Identify and protect primary wildlife movement corridors such as riparian corridors, and accommodate wildlife passage when designing fencing, culverts, stream crossings, and underpasses.
- Action wil10 (Phase 1) Institute seasonal prohibition of activities during breeding periods, and enact appropriate mitigation measures (e.g., buffer zones, restricted access) to adequately protect special-status or sensitive species in the absence of site-specific surveys.

SFPUC Water Enterprise Environmental Stewardship Policy

On June 27, 2006, the SFPUC established a policy (SFPUC 2006) for long-term management of SFPUC-owned lands and their natural resources, including the Alameda Creek watershed, as a fundamental component of the Water Enterprise mission. The policy states:

The SFPUC is committed to responsible natural resources management that maintains the integrity of the natural resources, restores habitats for native species, and enhances ecosystem function....It is the policy of the SFPUC to operate the SFPUC water system in a manner that protects and restores native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands. Releases from SFPUC reservoirs will (consistent with the SFPUC mission..., existing agreements, and applicable state and federal laws), mimic the variation of the seasonal hydrology (e.g., magnitude, timing, duration, and frequency) of their corresponding watersheds in order to sustain the aquatic and riparian ecosystems upon which these native fish and wildlife species depend.

As established in this policy, the SFPUC will monitor habitats, collaborate with interested and affected parties, and follow various strategies for implementation of the policy, e.g., updating the *Alameda Watershed Management Plan*, developing an HCP for the watershed, developing and implementing the Watershed and Environmental Improvement Program, participating in local forums including the Alameda Creek Fisheries Restoration Workgroup, and others. Of note as particularly pertinent to the CDRP, the policy commits the SFPUC to “ensure that the policy guides development of project descriptions, alternatives and mitigation for all SFPUC projects during the environmental review process under CEQA and/or National Environmental Policy Act (NEPA).”

4.4.2 IMPACTS

4.4.2.1 SIGNIFICANCE CRITERIA

CCSF has not formally adopted significance standards for biological resources impacts but generally considers that implementation of the proposed project would have a significant effect on biological resources if it were to:

- Have a substantial adverse effect, either directly or through habitat modification, on any species identified as endangered, threatened, candidate, rare, or special concern in local or regional plans, policies, regulations, or by lists compiled by the CDFG or USFWS;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFG or USFWS;
- Have a substantial adverse effect on federally and state protected wetlands as defined by Section 404 of the CWA and as protected under the Porter-Cologne Water Quality Control Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species, or with established native fish or wildlife migratory or dispersal corridors, or impede the use of native wildlife nursery sites (fish are addressed in Section 4.5, Fisheries and Aquatic Habitat);
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

CEQA Guidelines Section 15380 further provides that a plant or animal species may be treated as rare or endangered even if it is not on one of the official lists but otherwise meets the criteria for endangered or rare species (e.g., it is likely to become endangered in the foreseeable future).

4.4.2.2 APPROACH TO ANALYSIS

The effects of construction on wildlife species and vegetation were categorized as permanent or temporary. Permanent effects include loss of habitat in areas that would be destroyed, substantially altered, or would not be restored after construction, such as the location of the new dam and supporting facilities, borrow and disposal sites; and filling of the reservoir to its former elevation. Temporary effects include activities that would affect a species or its habitat only during the construction period. These activities include construction and use of haul roads and access and staging areas; where not within the inundation area of the re-established reservoir, these locations would be restored after construction is complete.

Effects of the CDRP were quantified, when possible, by calculating the amount and quality of habitat that would be affected directly and indirectly by the proposed project physical

components, construction activities and long term operation. Effects on wetland features and callippe silverspot butterfly habitat were calculated to 0.01 acre because they were mapped at this scale (ETJV 2006b). Effects on other habitats were calculated to the nearest acre.

As described in Section 3.5.1.7, there are two options for moving material between the dam site and Borrow Area E/Disposal Site 5: Haul Route Option 1 (west haul road) and Haul Route Option 2 (barge). Since both options are largely located within the area that would be inundated when the reservoir level is restored, impacts of the two options are almost the same; the west haul option would temporarily affect up to 1 acre of vegetation more than that of the barge option. Differences in impacts between the two options are footnoted in impact tables later in this section.

Effects of operation of the replacement dam are also evaluated and described in this section. Loss of habitat resulting from construction and re-filling of the reservoir is quantified. The effects of operations are not expected to cause a reduction in the area of downstream habitats but could affect their quality; therefore, the analysis of effects on downstream habitats is qualitative.

The SFPUC is proposing to implement flow releases consistent with the flow criteria described in the 1997 MOU to support native fishes in Alameda Creek as part of the proposed project. As further presented in Section 3.6.4 Resident Trout Flow Releases, flows would be provided through the proposed ACDD bypass tunnel whenever sufficient water is available in Alameda Creek and water would be released from Calaveras Reservoir through the proposed low-flow release valves during dry periods to meet the MOU flow and temperature criteria. Because the flow releases described in Section 3.6.4 are proposed as part of the project, the impact analysis below assumes their implementation under the future operations of the CDRP.

In addition to the Resident Trout Flow Releases, which were developed to support resident rainbow trout, the SFPUC also proposes to implement flow release schedules to support steelhead in the watershed in the future when steelhead have regained access above the BART weir as determined by NMFS as further described in Section 3.6.5 Steelhead Flow Releases and Section 6.2 Cumulative Impacts. Although the Steelhead Flow Releases would also benefit California red-legged frogs, foothill yellow-legged frogs, and riparian habitat, implementation of these additional flow releases will only occur when steelhead regain access above the BART weir. Because restoring steelhead access to the watershed requires actions that are outside of the control of the SFPUC, the timing and implementation of the proposed Steelhead Flow Releases is uncertain. Therefore, for purposes of providing a conservative, worst-case disclosure of the potential effects of the CDRP on vegetation and wildlife currently present in the watershed, implementation of the Steelhead Flow Releases is not assumed in the impact analysis below.

The SFPUC has identified four proposed mitigation areas which, when combined, contain adequate and feasible opportunities to fully compensate for the impacts described in this section (Appendix C.2). These are the South Calaveras, San Antonio, Sage Canyon, and Goat Rock

Mitigation Areas. This EIR includes a screening evaluation of impacts on the environment in the four mitigation areas. Surveys for sensitive species and habitats in the four mitigation areas were carried out in order to avoid or minimize potential impacts of mitigation measures that would disturb the environment. The impacts of the mitigation measures are discussed in Section 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project. The four mitigation areas also are included in the SFPUC's proposed Habitat Reserve Program (HRP), which will be the subject of a separate EIR to be published in 2010.

Following is a brief description of each mitigation area, characterizing each area and describing mitigation opportunities at each. In addition to restoring and establishing sensitive natural communities and species habitat, the mitigation areas would be preserved in perpetuity.

South Calaveras Mitigation Area

The South Calaveras Mitigation Area is a 641-acre area south of Calaveras Reservoir, located on SFPUC-owned land east of the intersection of Calaveras and Felter Roads and mostly north and east of Marsh Road in Santa Clara County. The area is a mosaic of oak woodlands, grasslands, and riparian habitats that is not accessible to the public. Vegetation is composed of non-native grassland (459 acres)⁹, mixed evergreen forest/oak woodland (16 acres), coyote brush scrub (18 acres), Diablan sage scrub (1 acre), mixed riparian woodland (10 acres), coast live oak riparian woodland (97 acres), valley oak woodland (9 acres), oak savannah (17 acres), seasonal wetlands (2 acres), and seep wetland (2 acres). There are four open water stock ponds totaling about 5 acres. A small portion (4 acres) of the mitigation area includes buildings and other structures associated with the former Calaveras Test Site, described in Section 4.9.1.4. Ephemeral drainages and intermittent streams, including Calaveras Creek, collect and convey water through the area. The mitigation area provides opportunities to enhance or establish about 11.42 acres of seasonal wetlands, 1.25 acres (5,254 linear feet [lf]) of intermittent stream, 0.32 acre (4,756 lf) of ephemeral channel, 5.13 acres of stock ponds, 4.2 acres of oak riparian forest, 3.3 acres of sycamore alluvial woodland, 2.2 acres of riparian scrub, 4.53 acres of perennial grasslands, and 9.0 acres of grasslands with the callippe silverspot butterfly larval host plant johnny jump-up (*V. pedunculata*). Aquatic habitat for the California red-legged frog and California tiger salamander is impaired by the presence of bullfrogs and predatory fish and could be improved by removing these predators.

San Antonio Mitigation Area

The San Antonio Mitigation Area is a 254-acre area located on SFPUC-owned land on the northeast shore of San Antonio Reservoir at the mouths of San Antonio and Indian Creeks in Alameda County. Vegetation includes non-native grassland (171 acres), mixed evergreen

⁹ Note that the acres of land cover presented for each mitigation area may not exactly match the size of the mitigation area as a result of rounding.

forest/oak woodland (10 acres), valley oak woodland (5 acres), mixed riparian woodland (12 acres), sycamore alluvial woodland (25 acres), willow riparian woodland (22 acres), Diablan sage scrub (7 acres), coyote brush scrub (2 acres), mulefat scrub (16 acres), seasonal wetland (1 acre), and 4 acres of open water in San Antonio Reservoir. The mitigation area provides opportunities to enhance or establish about 8.4 acres (5,600 lf) of intermittent stream, 10.5 acres of sycamore alluvial woodland, 19.6 acres of oak riparian forest, 28.0 acres of upland oak woodland, and 70.0 acres of oak savannah.

Sage Canyon Mitigation Area

The Sage Canyon Mitigation Area is a 584-acre area located on SFPUC-owned land north of the Arroyo Hondo arm of Calaveras Reservoir. It straddles the Alameda/Santa Clara County line and extends from the reservoir edge to the ridge top. The drainage where the ACDD tunnel terminates defines the western boundary of the mitigation area. Vegetation includes non-native grassland (309 acres), mixed evergreen forest/oak woodland (112 acres), valley oak woodland (3 acres), valley oak/blue oak woodland (1 acre), mixed riparian woodland (4 acres), Diablan sage scrub (101 acres), oak savannah (49 acres), and rock outcrop (5 acres). A small (about 0.31-acre) stock pond is located in the northeast portion of the mitigation area. On its northern boundary, the mitigation area is adjacent to federally designated critical habitat for Alameda whipsnake (Unit 5B) (USFWS 2006a). Cattle have access to the mitigation area although steep slopes reduce their use of the eastern portion of the area. The mitigation area provides opportunities to establish about 66 acres of Diablan sage scrub in grasslands adjacent to a large (186-acre) existing stand of Diablan sage scrub that extends east from within the mitigation area. About 38 acres of annual grasslands in the mitigation area contain the callippe silverspot butterfly larval host plant, johnny jump-up.

Goat Rock Mitigation Area

The Goat Rock Mitigation Area is a 35-acre area located on SFPUC-owned land situated between Valpe Ridge (a southeastern continuation of Apperson Ridge) and upper Alameda Creek just downstream from the ACDD. Vegetation includes 35 acres of serpentine grasslands containing a fine-textured mosaic of rocky outcropping supporting a very high diversity of native species. The mitigation area provides opportunities to enhance and preserve 35 acres of serpentine grasslands.

4.4.2.3 PROJECT IMPACTS

The vegetation and wildlife impacts described in this section are summarized in Table 4.4.8.

Table 4.4.8: Summary of Vegetation and Wildlife Impacts

Impact	Level of Significance ¹		
	Construction	Filling	Operation
4.4.1: Effect of CDRP on wetlands and other aquatic habitats.	LSM	LSM	LS
4.4.2: Effect of CDRP on California red-legged frog.	LSM	LSM	LSM
4.4.3: Effect of CDRP on California tiger salamander.	LSM	LSM	LS
4.4.4: Effect of CDRP on Alameda whipsnake.	LSM	LSM	LS
4.4.5: Effect of CDRP on callippe silverspot butterfly.	LSM	NI	NI
4.4.6: Effect of CDRP on bald eagle.	LSM	LS	LS
4.4.7: Effect of CDRP on foothill yellow-legged frog.	LSM	LSM	LSM
4.4.8: Effect of CDRP on Heermann's kangaroo rat.	NI	NI	NI
4.4.9: Effect of CDRP on other special-status species.			
4.4.9a: Effect of CDRP on western pond turtle.	LSM	LS	LS
4.4.9b: Effect of CDRP on nesting raptors.	LSM	LSM	LS
4.4.9c: Effect of CDRP on upland Species of Special Concern, bats, and migratory birds.	LSM	LSM	LS
4.4.10: Effect of CDRP on special-status plant species.	LSM	LS	LS
4.4.11: Effect of CDRP on sensitive vegetation communities.	LSM	LS	LS
4.4.12: Effect of CDRP on local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.	LSM	NI	NI
<i>Notes:</i> ¹ Levels of Significance NI – No Impact LS – Less than significant LSM – Less than significant with mitigation			

Impact 4.4.1: Effect of CDRP on wetlands and other aquatic habitats.

Impacts of Construction

The CDRP was designed to minimize impacts on wetlands and other aquatic habitats to the extent possible (URS 2008b); however, under the proposed construction of the project, impacts are not entirely avoided. Construction of the CDRP would result in direct fill of wetlands, streams, and

parts of Calaveras Reservoir. Sediment or other pollutant discharges during construction could degrade water quality of these habitats and result in adverse effects on vegetation and wildlife.

Assuming both haul route options were used, construction of various components of the CDRP would require the permanent fill of up to an estimated 2.8 acres of jurisdictional wetlands (freshwater marsh, seep wetlands, and seasonal wetlands), and up to 2.46 acres of non-wetland waters of the United States and waters of the state that include placement of fill in the reservoir and one pond as well as the loss of 4,682 linear feet of streams (Table 4.4.9). Freshwater marsh would be filled at Disposal Site 3. Seep wetlands would be affected at Disposal Sites 3 and 7. Seasonal wetlands would be affected by access, staging, and borrow areas, new dam construction, and the barge and west haul road options. Intermittent and ephemeral streams are widely dispersed around the reservoir and would be affected by many components of the project construction.

Table 4.4.9: Impacts of Construction on Wetlands and Other Waters of the State and United States

Resource	Permanent Impact ¹ Acres (Linear Feet)	Temporary Impacts ¹ Acres (Linear Feet)
Wetlands		
Freshwater Marsh	1.06	—
Seasonal Wetland	1.02	0.35 ²
Seep Wetland	0.72	0.19
Other Waters		
Perennial Stream	0.52 (1,284)	0.04 (158)
Intermittent Stream	0.07 (1,201)	0.02 (293)
Ephemeral Stream	0.06 (2,197)	0.04 (896)
Open Water (reservoir)	1.7	33.43 ³
Open Water (pond)	0.11	—
<i>Notes:</i> ¹ Includes all impacts even if they would be inundated by restoring the reservoir level. ² Reduce by 0.19 acre if only the west shore haul route is selected (see text). ³ Reduce by 23.0 acres if only the west shore haul route is selected (see text).		

Source: ETJV unpublished data 2009

An estimated 1.70 acres of open water associated with the reservoir would be permanently filled by portions of Disposal Sites 3 and 7 while 444 acres would be gained by re-filling the reservoir. A 0.11-acre pond would be filled by Disposal Site 7. The permanent loss of wetland, stream, riparian, and pond habitats would constitute a significant impact. Because the net increase in reservoir area would more than offset the 1.7 acres of open water habitat in the reservoir lost due to construction, the impact of construction on open water habitat in the reservoir would be less than significant.

In addition to its permanent impacts, construction would temporarily affect seasonal and seep wetlands, stream channels, and open water of the reservoir. An estimated 0.35 acre of seasonal wetlands would be filled by the west shore haul road and access areas (including 0.19 acre by the barge access, which would only be affected if that option is selected). About 0.19 acre of seep wetlands would be temporarily filled for construction access. Perennial, intermittent, and ephemeral stream channels would be temporarily affected by the dam, disposal sites, and haul roads. An estimated 33.43 acres of the reservoir aquatic habitat would be temporarily filled by project components, most substantially (23.0 acres) by the barge access area, which would only be affected if that option is selected. The temporary impacts of project construction on wetland, stream, and riparian habitats would be significant. Mitigation measures to address these potential significant impacts are discussed below. The temporary fill of 33.43 acres of open water habitat in the reservoir would be offset by the net increase of a nominal 444 acres of reservoir surface area when the reservoir is re-filled; therefore this impact would be less than significant.

The ACDD bypass facility would require work within the stream channel of Alameda Creek and would generate drilling waste at the downstream work area. The work area in the channel would be confined to the concrete apron at the foot of the dam, with a staging area in 0.25 acre of annual grassland north of the dam. The new bypass tunnel and associated hardware would be located entirely within and on the ACDD structure. Construction would be scheduled during the lowest-flow period (August through September) to minimize complications associated with working within the stream channel. Scaffolding and other construction equipment, including drill waste containment, collection, and disposal equipment, would be staged on the downstream concrete apron as much as possible. The proposed staging area would not be located in the channel nor affect any wetlands. There would be no permanent impacts on riparian habitat or the creek channel. Temporary impacts could occur within the stream channel upstream of and downstream of the ACDD if a temporary ramp is used to move equipment and materials from the staging area to the concrete apron.

Construction-related increases in sediment discharges and turbidity could adversely affect aquatic habitat quality in areas immediately adjacent to and downstream of project construction activities (see Section 4.7, Water Quality and Section 4.5, Fisheries and Aquatic Habitat). Construction activities would disturb channel bed materials and soils adjacent to waterways. Activities causing these disturbances include replacement of the dam in Calaveras Creek, construction of haul roads, use of borrow and disposal sites and access roads, and to lesser extent construction of the ACDD bypass. The resulting disturbance of channel bed materials and soil erosion would temporarily increase turbidity and may lead to sedimentation downstream of the construction sites when soils are transported in creek flows or stormwater runoff. In addition, the potential exists for contaminants such as fuels, oils, and other petroleum products used in construction activities to be introduced into aquatic habitat areas directly or through surface runoff. Contaminants may alter oxygen diffusion rates and cause acute and chronic toxicity to aquatic organisms. (See also

Section 4.7, Water Quality, for impacts of contaminants on water resources, as well as the discussion of effects on fish in Section 4.5, Fisheries and Aquatic Habitat.) Discharge of sediment or other pollutants into wetlands, streams and other aquatic habitat areas during project construction could have a significant impact on these resources.

Mitigation Measure 5.4.1, Avoidance and Minimization Measures, in Chapter 5, Section 5.4, requires the SFPUC and its contractors to implement avoidance and minimization measures to reduce impacts on aquatic habitat areas before and during project construction, including protective buffers and minimizing the number of stream crossings. Implementation of best management practices identified in Mitigation Measure 5.7.1, Stormwater Pollution Prevention Plan, in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, Section 5.7, would prevent impacts on aquatic habitats from discharge of sediment and other pollutants during project construction (see Section 5.7). Mitigation Measure 5.4.2, Habitat Restoration Measures, requires the SFPUC to restore temporarily impacted wetland, stream, pond, and riparian habitats located above the 756-foot inundation elevation within 3 years of completion of construction. Mitigation Measure 5.4.3, Compensation Measures, requires the SFPUC to compensate for temporal, long-term, and permanent losses of habitat areas, functions, and services by restoring, rehabilitating, re-establishing, establishing, enhancing, and/or preserving seasonal wetland, pond, stream, and riparian habitats to ensure no net loss of habitat area, functions, or services. The restoration and compensation requirements established by Mitigation Measures 5.4.2 and 5.4.3 will be further described in a detailed plan or plans and will be carried out in accordance with all required permits. The final restoration and compensation plan(s) will specify the objectives, detailed methods, performance standards, maintenance, monitoring, long-term management requirements, adaptive management plans, and financial instruments needed to ensure that the impacts on aquatic habitats will be fully mitigated. With the implementation of Mitigation Measures 5.4.1, 5.7.1, 5.4.2, and 5.4.3, the impacts of project construction on aquatic habitats would be less than significant.

Impacts of Filling the Reservoir

Upon completion of construction, the reservoir would be filled to the nominal Elevation 756 feet. Wetlands and stream habitat below the 756-foot elevation level would be inundated. Following the DSOD required reduction in reservoir level, seasonal wetlands developed within flat portions of the lakebed that had been formerly inundated, especially at the base of drainages. The largest of these formed on sediments exposed near the base of Calaveras Creek at the south end of the reservoir. Seep wetlands have become established in the exposed reservoir bottom, mostly along the east shore. Because of the reduced reservoir level, the channels of several small perennial, intermittent, and ephemeral streams that drain into the reservoir have extended across the formerly inundated area. These seasonal wetlands and extended stream channels would be inundated by filling the reservoir to the proposed surface elevation.

The areal extent of these features varies with several factors, especially fluctuating reservoir water levels. Wetlands and channels were delineated for the CDRP in February 2006 when the water level was at about Elevation 715 feet. During DSOD-restricted operations, the maximum water level has been about Elevation 732 feet, which would have reduced the size of wetlands identified during the delineation. Within these parameters, under DSOD-restricted operations the extent of wetlands and channels has ranged within at least the following amounts: freshwater marsh: 0 to 1 acre; seasonal wetland: 3 to 29 acres; seep wetland: 0 to 1 acre; perennial stream not including Arroyo Hondo: 520 to 1,940 lf; Arroyo Hondo: 7,520 to 9,420 lf; intermittent stream: 130 to 3,670 lf; and ephemeral channel: 140 to 5,150 lf. These features would be converted from wetland, riparian, and stream habitats to aquatic lake habitat/open water by filling of the reservoir.

Filling of the reservoir would result in a natural adjustment of seasonal wetlands along the edge of the reservoir pool as filling progresses. Similarly, existing stream channels on the exposed reservoir bottom would be inundated and their lengths would adjust seasonally to the fluctuating reservoir level. Because these readjustments would be within the general range of seasonal fluctuations of the reservoir, the impact would be less than significant. Seeps wetlands also would be inundated as the reservoir rises. The loss of these seep wetlands would be permanent. The impact is significant. Implementation of Mitigation Measure 5.4.3 would compensate for restore the functions and services of these seep wetlands in out of kind compensation.

Impacts of Operation

Operation of the reservoir under the CDRP is expected to re-establish wetland vegetation on the reservoir's edge at a higher elevation than under baseline conditions (described in "Aquatic Habitats" in Section 4.4.1, Setting, above). Figure 4.4.12, Detail of Seasonal Wetlands Under Pre-DSOD-Restricted Operations, shows an aerial photograph taken August 28, 1996. The green vegetation around the edge of the reservoir is consistent with similar vegetation observed in the 2006 aerial photograph in areas that were delineated as jurisdictional wetlands by May and Associates (URS 2008c, ETJV 2006b), described under baseline conditions for this EIR. A review of aerial photographs since 1993 indicates that the extent of seasonal wetlands along the margins of the reservoir has remained relatively constant despite dynamic changes in the reservoir elevation (URS 2008c). Aerial photos from 1993 and 2001, prior to the DSOD reduction in reservoir level, indicate that seasonal wetlands were present at or near the future normal water surface elevation of 756 feet (URS 2008c). These wetlands were common on the flatter portions of the shoreline and the confluences of drainages. The largest of the reservoir margin wetlands were located near the base of Calaveras Creek at the south end of the reservoir. Shrubs and trees that were associated with these wetlands are still present at this location (URS 2008c). Following the DSOD reduction in reservoir level, seasonal wetlands have developed at lower elevations along the waterline. As with current conditions, the areal extent of wetlands

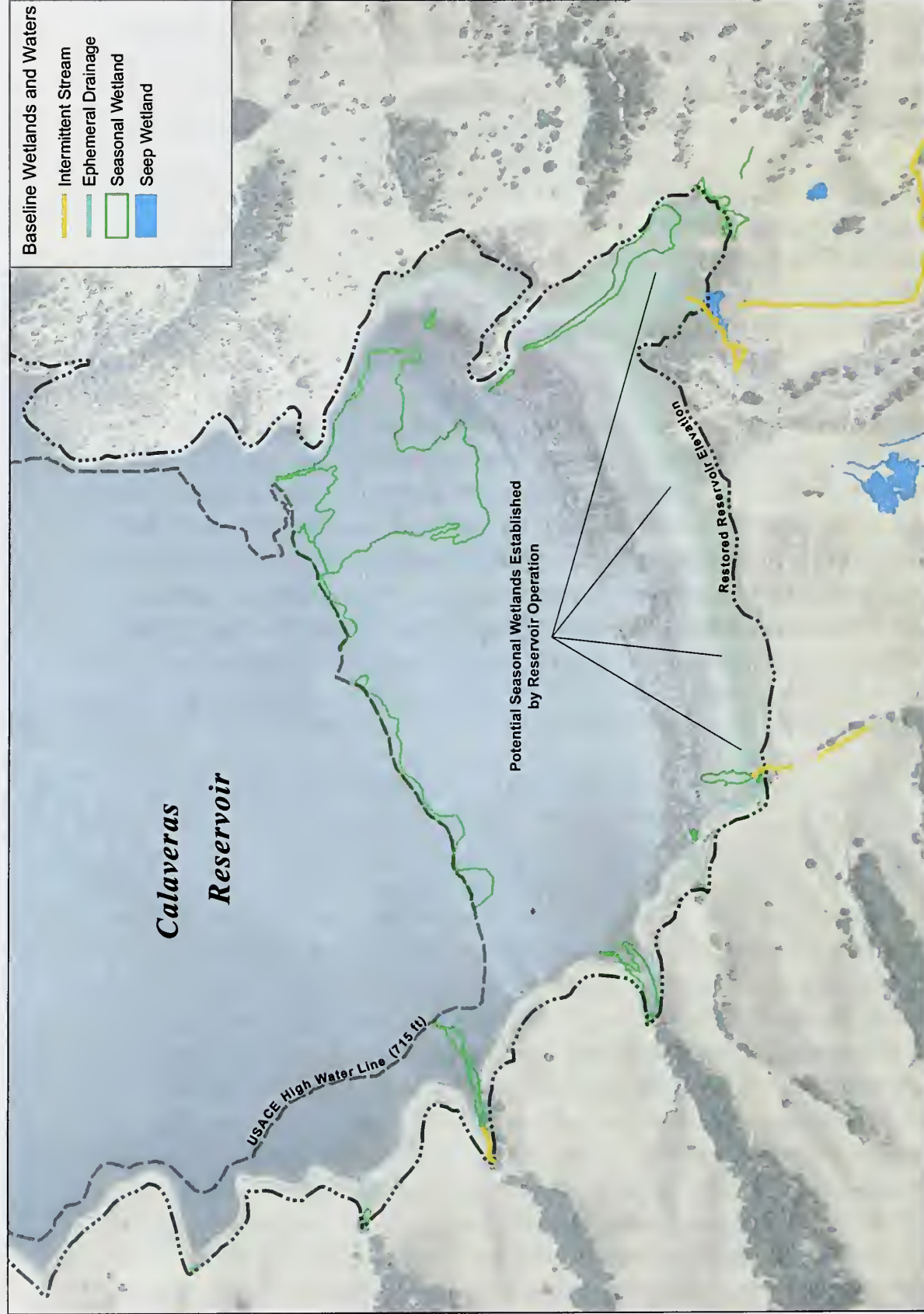


FIGURE 4.4.12: DETAIL OF SEASONAL WETLANDS UNDER PRE-DSOD RESTRICTED OPERATIONS

around the reservoir margin is expected to fluctuate with reservoir level as it is drawn down in summer and autumn and then filled during the winter and spring and varies as related to storage for a given water year. Thus, operation of the CDRP is expected to also support a dynamic range of seasonal and riparian wetlands along the margin of the reservoir.

The proposed operation of the reservoir would reduce winter/early spring flows in Calaveras Creek downstream of the dam in normal, above-normal, and wet water years (see Impact 4.6.4 in Section 4.6, Hydrology). However, this reduction in winter/spring flows would result in flow conditions that are within the range of current flows in Calaveras Creek in winter months. Operation of the proposed project would increase dry season flows in Calaveras Creek and the reaches of Alameda Creek downstream of the ACDD relative to the baseline as a result of the implementation of minimum flows for fish under the 1997 MOU with CDFG. Under the baseline conditions, dry season flows downstream of the confluence are typically 1 cfs or less (see Sections 4.5, Fisheries and Aquatic Habitat, and 4.6, Hydrology, for more detail). As described in Impact 4.4.2, following the initial filling of the reservoir, minimum dry season flows of 5–7 cfs would be provided at the ACDD (when available) and at Calaveras Dam when not available in Alameda Creek to meet 1997 MOU flow requirements. During the period comprising the CDRP baseline, diversions from Alameda Creek at the ACDD occurred in 6 out of 9 water years (Table 4.4.10). When the diversion tunnel was open, only flows above 650 cfs contributed water to the reaches downstream of the ACDD, impairing functions and services in that reach, especially for aquatic wildlife. Minimum bypass flows would ensure that as long as water is present in Alameda Creek upstream of the ACDD, the reach below ACDD would remain wetted and would provide aquatic habitat every year. High-intensity scouring flows in Calaveras Creek and downstream in Alameda Creek resulting from the sustained releases from the cone valve to comply with DSOD restricted reservoir operating range would be reduced. On the other hand, cone valve releases and spills from the reservoir in very wet years would occur more frequently than under baseline conditions (no spills have occurred due to the DSOD-restricted water level).

Table 4.4.10: Operations of the Alameda Creek Diversion Tunnel During DSOD Restrictions (2001 to Present)

Opened	Closed	Water Year Affected (October 1 to September 30)
November 13, 2002	December 18, 2002	2003
February 13, 2003	May 2, 2003	2003
September 29, 2003	October 24, 2004	2003, 2004, 2005
March 13, 2007	February 5, 2008	2007, 2008
November 3, 2008	February 27, 2009	2009

Source: SFPUC 2008

Altered flows in Alameda and Calaveras Creeks as a result of ACDD diversion into Calaveras Reservoir, increased impoundment behind the dam, and implementation of bypass flows at the

ACDD could have impacts on riparian habitat (see Section 4.6, Hydrology). Riparian vegetation in these reaches is generally well developed, self-sustaining (i.e., is regenerating and is not senescent), and, to the extent that it is degraded, the degradation is primarily the result of disturbance by cattle (Jones & Stokes 2006, p. 3-37; SFPUC 2007, p. 4.6-17; Bookman-Edmondston 1995, Appendix C, p. 20). Riparian vegetation germination and seedling survival are dependent on streamflows. Flows that are too low can desiccate seedlings that germinate high on the creek bank, and seedlings supported deeper in the channel by low flows are susceptible to scouring by high winter and spring flows. Without recruitment of new growth, the riparian plant community will degrade and provide fewer habitat values. Beyond providing suitable conditions for establishment, flows must also be sufficient to maintain existing riparian vegetation year-round.

Implementation of the proposed project would result in reduction in winter flows in normal or wetter years and an increase in flow in summer months of all year types and winter months of below-normal or dry years. Large flow events in wet years would be reduced; however, the existing pattern of high-flow events during periods of substantial runoff would be partially maintained in late winter and early spring of wet years. Although flow patterns would be altered in the reaches of Alameda Creek downstream of the ACDD and the confluence with Calaveras Creek, the net flow in the creek on an average annual basis would not change appreciably from the existing condition. There would be alterations to the timing of flows in Alameda Creek with implementation of the project; however, winter peaks in wet years would largely still take place, and the net change in the average annual flow rate in the creek would not be substantial.

Therefore, streamflows would not be altered to such an extent that they would be outside the range of existing conditions. The change in flows would have no expected net effect on the riparian woodland communities; for stand regeneration, sycamore woodland requires flows similar to unimpaired flows. The potential reduction in flows during winter and spring (as it relates to stand regeneration for willow and alder riparian forest) would be offset by increased summer flows under the 1997 MOU. Sustained winter and summer minimum flows could facilitate the conversion of existing riparian habitats, such as sycamore alluvial woodland and valley oak woodland, to alder- and willow-dominated habitats, but the extent of this potential impact would be small. Channel incision is not expected to be an important factor because of the large cobble content of the substrate.

Similar to the above, the project would alter flows in the extended study area. No CDRP facilities are proposed in the extended study area. The project's impacts on flows downstream of the confluence with Arroyo de la Laguna would be difficult to distinguish from the flows introduced via Arroyo de la Laguna. In addition, the proposed MOU flow releases from the ACDD bypass and Calaveras Dam would provide additional flow in the reaches of Alameda Creek from the confluence with Calaveras Creek down to about the Sunol quarries area but not downstream of there in below-normal and dry years compared to the baseline when flows have

been diverted at the ACDD in below-normal and dry years: this may be beneficial to riparian habitat in the affected stream reaches.

Impact Conclusions

Project design and Mitigation Measures 5.4.1 and 5.7.1 would prevent inadvertent fill, disturbance, discharge of pollutants, and other impacts on aquatic habitats during project construction. However, even with the implementation of these avoidance measures, construction activities would result in temporary and permanent loss of an estimated 1.06 acres of freshwater marsh, 1.37 acres of seasonal wetlands, 0.91 acre of seep wetlands, 0.11 acre of pond, 0.56 acre (1,442 lf) of perennial streams, 0.09 acre (1,494 lf) of intermittent streams, and 0.10 acre (3,093 lf) of ephemeral streams. Re-filling of the reservoir would affect a range of wetland and stream habitats.

Mitigation Measure 5.4.2 provides for restoration of the habitats temporarily impacted during construction and requires the SFPUC to ensure the re-establishment of wetlands inundated by refilling of the reservoir. Mitigation Measure 5.4.3 requires compensation for permanent impacts on wetlands, pond habitat, streams, and riparian habitat in the South Calaveras and San Antonio Mitigation Areas. Restoration and compensation actions would be undertaken in accordance with a plan or plans and related permits. These measures would reduce temporary and permanent construction impacts and inundation impacts on wetland, stream, pond, and riparian habitats to a less-than-significant level.

The loss of open water/aquatic lake habitat in the reservoir (1.7 acres permanent impact and 33.43 acres temporary impact) would be offset by a gain of over 444 acres of reservoir surface area and associated aquatic lake habitat. Therefore, the impacts of the project on open water/aquatic habitat area associated with the reservoir would be less than significant.

A dynamic range in the extent of seasonal and riparian wetlands is expected to re-establish along the margins of the reservoir after it is refilled (URS 2008c, p. 8). The expected re-establishment of these habitats around the margins of the reservoir would offset the loss of the seasonal wetlands that would be inundated, the extent of which varies with reservoir elevation.

Seep wetlands are not expected to be restored on the margins of the reservoir, but their functions and services could be restored out of kind by other wetland habitats through Mitigation Measure 5.4.3, which requires compensation for permanent impacts on wetlands, including the seep wetlands that would be inundated. An adaptive management plan is required if the restoration objectives are not met in accordance with the success criteria specified in the final mitigation plan.

The inundation impacts on streams would be mitigated by improvements to existing stream habitats elsewhere in the watershed, as required by Mitigation Measure 5.4.3. Impacts of

inundation on Arroyo Hondo would be offset by improvements to the functions and services of more than 16,000 feet of Alameda Creek downstream of the ACDD as a result of implementing minimum bypass flows proposed by the CDRP.

With the mitigation measures described here, the impacts of the proposed operations of the reservoir on aquatic and riparian habitat in Alameda Creek downstream of the ACDD, in Calaveras Creek downstream of the dam, in Alameda Creek downstream of the confluence with Calaveras Creek, and in the extended study area would be less than significant.

Impact 4.4.2: Effect of CDRP on California red-legged frog.

Impacts of Construction

Construction of the proposed project could result in direct mortality of California red-legged frog adults, tadpoles, and egg masses, and the temporary and permanent loss and degradation of California red-legged frog habitat. Potential indirect effects of the project include reduced water quality, which in turn could result in direct or cumulative adverse effects to individuals and their life cycles.

Table 4.4.11 provides a conservative estimate of California red-legged frog habitat that could be directly affected by the project and distinguishes between permanent and temporary effects. Effects are measured in lf where aquatic habitat is a stream (e.g., Calaveras Creek). Construction of the dam would affect 945 lf (=0.50 acre) of aquatic breeding habitat in Calaveras Creek, and 0.11 acre of aquatic breeding habitat at Disposal Site 7. The quality of both of these habitat locations is impaired by the presence of predatory bullfrogs and (in Calaveras Creek) non-native fish. Aquatic non-breeding habitat affected by the CDRP includes 1.78 acres and 1,536 lf of permanent impacts, and 0.19 acre and 452 lf of temporary impacts. Most of these impacts are at freshwater marsh and seep wetlands affected within the dam construction area and at disposal sites 3 and 7. Upland and dispersal habitat affected by the CDRP includes 233 acres of permanent impacts and 66 acres of temporary impacts. This habitat is mostly affected by the project within the dam construction area and at disposal sites 3 and 7. If frogs were present in these construction sites, mortality or injury of individuals of this protected species would be an expected outcome given the substantial amount of earthmoving, operation of mechanical equipment, frequent haul truck movements, human activities, trenching that could trap frogs, etc. The impact would be significant.

Table 4.4.11: Maximum Acreage of California Red-Legged Frog Habitat to Be Affected by the Proposed Project

Project Activity	California Red-Legged Frog Habitat to Be Affected ^{1,2}					Timing
	Aquatic Breeding		Aquatic Non-Breeding		Upland/Dispersal	
	Acres	Linear Feet ³	Acres	Linear Feet ³	Acres	
Permanent Construction	0.11	945	1.78	1,536	233	Year 1-Year 4
Temporary Construction	–	–	0.19	452	66	Year 1-Year 4
Filling Reservoir	–	9,421	0.36	2,399	357	1 wet season if wet year, 4 years if “normal” year, 7 years if “dry” years
Notes: ¹ See Table 4.4.3 for habitat definitions. ² Calculations only include effects of construction and re-filling and do not include potential operational effects in Calaveras and Alameda Creeks downstream of the new dam, which are discussed qualitatively in the text. ³ Streams are measured in linear feet, rather than acres.						

Source: ETJV unpublished data 2009

The ACDD bypass would require work within the Alameda Creek stream channel. Construction would be scheduled during the lowest-flow period (August through September), which would avoid impacts on breeding California red-legged frogs. Adult or young California red-legged frogs could be killed or injured if they were present within the work area. California red-legged frogs could also be indirectly affected during construction if water quality in Calaveras Creek or Alameda Creek is polluted by chemical spills or ground-disturbing activities result in erosion and discharges of sediment or other contaminants into the creeks.

Impacts of Filling the Reservoir

Filling the reservoir would inundate 9,421 lf of aquatic breeding habitat in Arroyo Hondo, with approximately 14 potential breeding locations. Breeding habitat in Arroyo Hondo is impaired by the presence of predatory bullfrogs. Arroyo Hondo is a moderate-gradient stream with perennial flow, primarily gravel and cobble substrate with side pools and backwaters, and relatively dense riparian vegetation. Under baseline conditions the lower half of this reach is still periodically inundated by the reservoir and has little riparian or perennial aquatic vegetation and only a few potential breeding locations; the upper half is not currently subject to inundation and has more potential breeding locations. A habitat assessment conducted by EDAW in spring 2007 found four potential breeding locations in the lower half of Arroyo Hondo and 10 in the upper reach (EDAW unpublished data 2007).

Filling the reservoir would also affect 0.36 acre and 2,399 lf of aquatic non-breeding habitat, and 357 acres of upland and dispersal habitat, around the shoreline of the reservoir.

Once construction of the dam is complete, filling and long-term operation of the reservoir would re-establish the diversion of most flows in Alameda Creek. A substantial reduction in annual flow as compared to the existing DSOD-restricted-operations conditions would occur downstream of the ACDD. However, the operation would not return to that of pre-DSOD-restriction conditions. Instead, beginning at the end of construction, the 1997 MOU releases would be initiated and continued in perpetuity.

Impacts of Operation on Calaveras Creek Downstream of the Dam, Alameda Creek Downstream of the ACDD, and Alameda Creek Downstream of the Confluence with Calaveras Creek

Operation of Calaveras Dam could result in changes to the hydrologic functioning of streams and alter the timing, duration, water flows, and levels that could degrade or eliminate the California red-legged frog and/or its habitat. Operation of Calaveras Dam could affect California red-legged frogs and habitat in four reaches: (1) Calaveras Creek downstream of Calaveras Dam (Reach C-1), (2) Alameda Creek between ACDD and the confluence with Calaveras Creek (Reaches A-3 and A-4, discussed above), (3) Alameda Creek from Calaveras Creek to Arroyo de La Laguna (Reaches A-1 and A-2), and (4) Alameda Creek in the extended study area. These reaches are discussed separately in detail.

Calaveras Creek Downstream of the Dam

Under the proposed project, average flows in Calaveras Creek downstream of the dam are expected to be lower in the winter and early spring of wet and above-normal precipitation years compared to existing conditions. This expectation is based on hydrologic modeling (see Section 4.6, Hydrology). This is largely due to the future ability of the reservoir to store winter and spring rain and runoff rather than needing to release rain and runoff downstream to maintain the reservoir at the restricted level. However, there is an existing year-round base flow of about 0.5 to 1 cfs supported by seepage at the dam. Future operation of the Calaveras Dam establishes minimum flows throughout the winter, spring, and summer consistent with the releases provided for in the 1997 MOU with CDFG (see Appendix H). During much of the year, minimum flows would bypass the ACDD; however, when sufficient flows are not available in Alameda Creek,¹⁰ the MOU flows would be met by releases from Calaveras Dam. Summertime flows would be

¹⁰ When flows in Alameda Creek at the MOU monitoring point (the confluence of Calaveras and Alameda Creeks) drop below 7 cfs, they would begin to be supplemented with flows released from Calaveras Reservoir, assuming other MOU requirement are being met. This could happen anytime from March to September, depending on the water year. In a recent dry year (2007), flow at the ACDD dropped below 7 cfs by mid-March, with no measurable flow by the end of August; in a recent wet year (2006), flows dropped below 7 cfs in early June, with no measurable flow by late September (USGS 2009).

released from Calaveras Dam to meet MOU water temperature requirements. Under the MOU, these flows, as measured at the confluence of Calaveras and Alameda Creeks, would range from 20 cfs in late winter to 7 cfs through spring and summer and 5 cfs in fall and early winter.

Flows released at the dam would have less benefit for the California red-legged frog than flows bypassed from the ACDD. Calaveras Creek downstream of the dam is a mostly confined channel with several large, wide (>20 feet) perennial pools immediately downstream of the dam at the stilling basin and other large pools within boulders and bedrock in a steep gradient (lacking emergent vegetation) and at the confluence with Alameda Creek. These pools are impaired by the presence of large numbers of bullfrogs and non-native fish. MOU flows would increase flow velocity through these pools but would not result in flooding of emergent vegetation, scouring of egg masses, or entraining of tadpoles, all of which would preclude use by red-legged frogs. The release of MOU flows into Calaveras Creek would not substantially improve habitat for bullfrogs, which are known to breed in pools immediately downstream of the dam and at the confluence with Alameda Creek. Bullfrogs would continue to have year-round access to the reach. Bullfrog tadpoles can take more than a year to metamorphose and so have a higher survival rate in perennial pools. Available pools are already supported year-round by seepage of water at Calaveras Dam and pool habitat for bullfrog and non-native fish would persist in this reach.

Under operation of Calaveras Reservoir at the current DSOD-restricted level, the spillway has not been used. Since the DSOD restriction in 2001, releases from the reservoir have been made through the 72-inch cone valve during several months in 3 years: December 2001 through February 2002, March through May 2005, and March through June 2006. These releases have ranged from an average of 336 cfs to 375 cfs. As further discussed in Section 3.6.1, Changes in Reservoir Operation, compared to baseline conditions, the higher reservoir level under the proposed project would increase the frequency of spills through the spillway and cone valve but would decrease the duration of releases through the cone valve. Maximum cone valve flows can be reached within 4 hours. Rapid or sudden increases or decreases in flow releases associated with cone valve releases have the potential to strand egg masses or wash away egg masses, tadpoles, or adult California red-legged frogs, as well as bullfrogs and non-native fish, from downstream areas in Calaveras and Alameda Creeks.

Under DSOD safety regulations, the SFPUC is required to exercise (operate) the 72-inch cone valve to demonstrate the ability to draw down the reservoir during an emergency. Accordingly, the SFPUC releases water from the reservoir through the cone valve at least every 2–3 years. Releases are made either to maintain the reservoir level downstream of the spillway elevation as part of normal operations or, if operational releases are not needed for an extended period, releases are made for testing purposes only.

Depending on the timing and volume of releases, they could wash away adults, eggs or tadpoles. However, the Project Description includes an operations plan to minimize impacts of cone valve releases on spawning fish and amphibians. With this plan, releases from the cone valve will be conducted outside of the period from January to May, and will be conducted from September through November whenever possible. Peak egg deposition for California red-legged frog is typically mid-March to late March; eggs hatch in 18–22 days. Cone valve releases outside of the peak period of spring egg deposition and hatching would minimize potential disruption to California red-legged frogs breeding within Calaveras and Alameda Creeks immediately downstream of Calaveras Dam that may otherwise result from cone valve releases. Further, the plan would include the development and implementation of flow release ramping criteria for Calaveras Dam for a full range of potential flows that could be released from the low flow and cone valves. The ramping criteria would only be applied to planned (non-emergency) releases and would prescribe rates and timing of both increases and decrease in releases to Calaveras and Alameda Creeks to minimize stranding or entrainment of native fish and amphibian species. Therefore, potential impacts to California red-legged frog breeding in Calaveras and Alameda Creeks immediately downstream of Calaveras Dam as a result of cone valve releases would be less than significant.

Alameda Creek Downstream of ACDD to Calaveras Creek Confluence

Because of restrictions in reservoir storage since 2001, local inflows to Calaveras Reservoir from Calaveras Creek and Arroyo Hondo have generally been sufficient to replenish DSOD-allowed reservoir storage, and diversions from ACDD have been reduced, especially in wet years, compared to pre-DSOD restricted operations and expected future operations. Flows from Alameda Creek have been diverted to Calaveras Reservoir during 5 years since the 2001 restriction: November 13, 2002 to December 18, 2002; February 13, 2003 to May 2, 2003; September 29, 2003 to October 24, 2004; March 13, 2007 to February 5, 2008; and November 3, 2008 to February 27, 2009.

Diversions have the potential to affect frogs especially during the mid-to-late-March peak breeding season and when eggs and tadpoles are dependent on aquatic habitat. California red-legged frogs take, on average, about 20 weeks to develop from egg to terrestrial frog (USFWS 2002b, p. 19249). As reported in SFPUC (2008), during a below-average precipitation year with continuous diversions, the channel began drying between May 1 and May 17. Short disconnected sections dried first in the wide, alluvial lower portion of the reach, and drying continued steadily through late spring and summer.

Proposed operation of the ACDD would divert most of the flow of Alameda Creek into the reservoir, especially high winter/spring (December through March) flows. As discussed above, future operations would provide flow releases through bypasses at the ACDD when natural flows

are available (expected in winter and spring). When natural flows are not adequate to meet the criteria for flow volume and temperature through bypasses at the ACDD (e.g., in summer), the proposed flow schedules would be met by flow releases through the two low-flow release valves that would be installed at the proposed replacement Calaveras Dam. The flow release schedules specified in the MOU are intended to support resident rainbow trout, but the resulting flows would also support California red-legged frog and other amphibians. As described above (under “Impacts of Filling the Reservoir”), establishing bypass flows would provide minimum flows that would be especially important for maintaining habitat for eggs and tadpoles compared to years in the baseline period when flows were diverted at ACDD. Compared to the baseline, minimum flows would provide more water during the California red-legged frog breeding and rearing season. Minimum flows would provide less water than under baseline years without diversion; however, they would maintain habitat availability for California red-legged frog in Alameda Creek downstream of the ACDD by providing sufficient flow to sustain breeding habitat. Therefore, with the project, breeding and rearing habitat would be present annually (as long as that water is available within the watershed) compared to the baseline, which included years where suitable conditions for breeding and rearing were impaired by diversion of all flows under 650 cfs. Bullfrogs have not been detected upstream of Little Yosemite (Bobzein, pers. com. 4/22/08), and operation of the ACDD would not result in new permanent sources of water that would improve their ability to become established in this reach.

Alameda Creek from Calaveras Creek to Arroyo de la Laguna

Operation of Calaveras Dam under the proposed project includes minimum flows under the 1997 MOU with CDFG to provide for fish habitat. In contrast to Calaveras Creek, where the channel is confined, in the wider channel in this reach of Alameda Creek, these minimum flows would likely provide year-round aquatic habitat for red-legged frogs downstream of the confluence with Calaveras Creek and would reduce the likelihood that egg masses or tadpoles would become stranded because of inadequate flows during the breeding season. Likewise, habitat conditions for bullfrogs, which are already present in the reach, would likely improve with greater reliability of aquatic habitat throughout the year. This effect would extend into the reach of Alameda Creek where it becomes a “losing reach” (net reduction in surface water flows between two points) downstream of the SVWTP (ENTRIX 2006, CDFG 1997). EBRPD described California red-legged frog reproductive output for this reach as “very low” compared to an unimpaired reach at Camp Ohlone upstream of the ACDD (EBRPD 2007, p. 37) and described most of the reproductively successful drainages within their park system as being relatively free of bullfrogs and non-native fish (EBRPD 2007, p. 30). If predation and/or competition from bullfrogs increases to such an extent that California red-legged frogs no longer use this reach for breeding, this would be a significant impact. The extent of potentially increased predation and competition by bullfrogs in Alameda Creek downstream of the confluence with Calaveras Creek cannot be known until bypass flows begin. Therefore, Mitigation Measure 5.4.3 requires the development

and implementation of a Compensation Plan with monitoring and ecologically based success criteria to determine whether the compensation objectives for California red-legged frog are achieved and requires adaptive management measures if necessary to ensure that the loss of California red-legged frog breeding habitat is fully mitigated. With the implementation of Mitigation Measure 5.4.3, this impact would be less than significant.

California red-legged frog breeding in Alameda Creek is influenced by volume and duration of streamflow, and it appears that California red-legged frogs can use breeding habitat in creeks that experience some naturally occurring short-duration high flows but not long-duration high flows (EBRPD 2007, p. 39). Research conducted by EBRPD in 2005 and 2006 indicates that there was no successful breeding effort by amphibians in Alameda Creek downstream of the confluence with Calaveras Creek when the flow measured at the Welch Creek gaging station exceeded 300 cfs for more than 2 weeks during the breeding season (Bobzien, pers. com.; EBRPD 2007, p. 39). Sustained high flows could occur during the California red-legged frog breeding season in Calaveras Creek downstream of the dam and in Alameda Creek downstream of the confluence with Calaveras Creek as a result of operation of the CDRP, to the extent that short-duration springtime high flows are captured in Calaveras Reservoir and are released over a longer period (relative to the natural hydrograph) through the cone valve and spillway. This effect would be reduced compared to baseline conditions under operation of the CDRP and therefore is a less-than-significant impact.

Alameda Creek in the Extended Study Area

In Niles Canyon and lower Alameda Creek, habitat conditions have been heavily modified and altered as a result of past human activities including: utilizing the creek as a conveyance facility for water supply; constructing levees and maintaining the channel for flood control; mining aggregate; urbanizing of adjacent areas; and diking, channelization, and pond construction for commercial salt production. Water supply, erosion control, and flood control structures were constructed in the channel, including the BART weir and a series of inflatable dams for water supply impoundment (including capture of flows imported from the Sacramento – San Joaquin Delta via the South Bay Aqueduct), local aquifer recharge, and diversion. These features impair habitat functions and would be expected to continue to do so for an undefined time.

Aquatic habitat conditions in the extended study area are characterized by variable summer flows, high summer water temperature, substrate with a large silt component, extensive stands of emergent vegetation, and tidal mixing, with increased salinity in the lower sections near the bay and freshwater flows in the higher-lying reaches upstream of the BART weir. Some sections may be dry during the summer (Hanson Environmental Inc. 2002).

Modeling to predict possible flow changes in the segment of Alameda Creek within the extended study area, which may result from operation of the proposed CDRP, is described in Section 4.6,

Hydrology, 4.6.2.2, Approach to Analysis. According to this flow modeling, the proposed project would reduce flows in Niles Canyon in the December to March timeframe in normal, above-normal, and wet years, but flows would increase in April and May except for a slight decrease in April of wet years and May in above-normal years. No change would occur in dry years. Slight to moderate changes would occur in below-normal years. No changes in flow would occur in below-normal and dry years as a result of the project operation.

These predicted changes in the flow regime could result in associated small changes in habitat conditions in lower Alameda Creek; however, these potential changes would be diminished by operations of other water resource management entities in the watersheds that supply Arroyo de la Laguna and would not be expected to result in changes to the extent that habitat conditions would be limited in lower Alameda Creek for the California red-legged frog.

Impact Conclusions

Construction and operation of the proposed project could result in direct mortality of California red-legged frog adults, tadpoles, and egg masses, and the temporary and permanent loss and degradation of aquatic breeding, aquatic non-breeding, upland, and dispersal habitat. Project construction would result in permanent loss of 945 lf of breeding habitat for red-legged frogs in Calaveras Creek and a 0.11-acre pond at Disposal Site 7. If California red-legged frogs were present in these habitats at the time of construction, injury or mortality of individuals would be expected. Indirect effects of construction could include a reduction in water quality resulting from erosion or spills of fuel or other hazardous materials during construction. These direct and indirect effects would be significant impacts. Mitigation Measures 5.4.1, 5.4.2, and 5.7.1, identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, would reduce these impacts to less-than-significant levels by requiring pre-construction avoidance and minimization measures, restoring habitat, and preventing water quality degradation. In accordance with Mitigation Measure 5.4.3 the SFPUC would compensate for temporary and permanent habitat loss by improving aquatic breeding habitat in the South Calaveras Mitigation Area and enhancing and/or protecting and maintaining aquatic non-breeding habitat (shallow perennial and intermittent channels), upland habitat, and dispersal habitat at all four mitigation areas.

Filling the reservoir would result in permanent loss of up to approximately 14 potential breeding locations in Arroyo Hondo that would be inundated by the new reservoir elevation. This would be a significant impact. Improvements to California red-legged frog breeding habitat in Alameda Creek from the ACDD to the confluence with Calaveras Creek resulting from minimum flows bypassed at the ACDD is expected to offset this loss; however, until bypass flows begin, the extent of improvements cannot be known and cannot be compared to the impact on Arroyo Hondo. Therefore, Mitigation Measure 5.4.3 requires ecologically based performance standards

to determine whether the compensation objectives for California red-legged frog are achieved and requires adaptive management to ensure that the loss of California red-legged frog breeding habitat is fully mitigated.

Under future operation of the Calaveras Dam and ACDD, establishing bypass flows at the ACDD could improve conditions for California red-legged frogs in Alameda Creek; implementing them from Calaveras Dam in summer and fall would improve habitat conditions especially during critical dry season flows.

Timing of cone valve releases under the proposed Cone Valve Operations Plan outside of the peak period of spring egg deposition and hatching, and ramping of non-emergency releases, would minimize potential disruption to California red-legged frogs breeding within Alameda Creek immediately downstream of the confluence with Calaveras Creek that may otherwise result from cone valve releases. Therefore, relative to baseline conditions, operations of the cone valve under the CDRP would have a less than significant impact on the California red-legged frog.

In Alameda Creek downstream of Calaveras Creek, operation of the CDRP would increase dry season flows but reduce wet season flows. Dry season flows would be increased by providing minimum flows established in the MOU (CDFG 1997), which would increase Calaveras Creek flows. This would improve aquatic habitat in Alameda Creek by increasing aquatic habitat availability (especially in the spring and summer months) and reducing the risk of desiccation of eggs or tadpoles. Calaveras Creek dry season flows would increase and would continue to provide aquatic habitat in this reach. Increased dry season flows would likewise improve habitat for bullfrogs, which prey on and compete with native frogs and which have robust breeding populations in pools downstream of the dam and at the confluence; bullfrogs would continue to move throughout the reach and their population could benefit from greater reliability of aquatic habitat, especially tadpoles, which require perennial water. Overall, aquatic breeding habitat for California red-legged frog would increase, but the level of impairment by bullfrogs would also likely increase. If predation and/or competition from bullfrogs increases to such an extent that the California red-legged frog population is substantially reduced, this would be a significant impact.

Because predicted changes in the flow regime and associated changes in habitat conditions in lower Alameda Creek would be relatively small and would be diminished by operations of other water resource entities in the Arroyo de la Laguna watershed, operation of the proposed CDRP would not be expected to result in significant changes to habitat conditions in the extended study area. This impact would be less than significant.

Impact 4.4.3: Effect of CDRP on California tiger salamander.

Impact of Construction

Table 4.4.12 provides the maximum acreage of California tiger salamander habitat that could be affected by the project. In areas where temporary project components, such as haul roads or staging areas, would be inundated after the reservoir is filled, the impacted acreage is calculated only as an effect of filling the reservoir. Potential effects to tiger salamander aquatic habitat would be very small and would result from the permanent loss of Pond 9 at Disposal Site 7 (0.11 acre). This pond was considered impaired because of the presence of non-native predators. The remainder of potential habitat effects on tiger salamander would be in upland refuge, forage, and dispersal habitat.

Table 4.4.12: Acreage of California Tiger Salamander Habitat to Be Affected by the Proposed Project

Project Activity	California Tiger Salamander Habitat to Be Affected (acres)				Timing
	Aquatic	Upland			
	Total	Refuge and Forage	Dispersal	Total Upland	
Permanent Construction	0.11	131.5	33.1	164.6	Year 1-Year 4
Temporary Construction	–	26.3	4.1	30.4	Year 1-Year 4
Filling Reservoir	–	256.0	50.0	306.0	1 wet season if wet year, 4 years if “normal” year, 7 years if “dry” years
Note:					
See Table 4.4.4 for habitat quality definitions.					

Source: ETJV unpublished data 2009

Construction of the new dam and facilities would result in the permanent loss of 164.6 acres and temporary loss of 30.4 acres of upland habitat. California tiger salamanders occupy upland habitat most of the year, and construction in upland habitat could cause death or injury to California tiger salamanders. Construction activities in upland habitat, such as grading or excavation at borrow areas, as well as the use of staging, access, and disposal sites, have the potential to kill tiger salamanders that are in burrows or moving over the roadways.

As shown in Figure 4.4.7, upland habitat occurs throughout much of the project area except in the vicinity of the dam. The majority of the effects on upland California tiger salamander habitat would be caused by Borrow Area E on the south shore.

During construction of the project, there is potential for California tiger salamander to be killed or injured by haul trucks or other construction traffic when salamanders disperse from upland to aquatic habitat. Once fall or winter rains begin, adult California tiger salamanders move seasonally from upland habitat to aquatic breeding pools for short periods (1–8 weeks) to breed and lay eggs. Movements typically occur on mild rainy nights (USFWS 2004, p. 47216). After breeding, adults leave the pool and return to small mammal burrows in surrounding uplands although they may continue to come out nightly for approximately the next 2 weeks to feed (USFWS 2004, p. 47216). After eggs develop and larvae metamorphose, juvenile California tiger salamanders move in late spring from the aquatic habitat to upland habitat (USFWS 2004, p. 47216). Construction-related traffic could affect adult and juvenile California tiger salamanders' seasonal and dispersal movements. Truck traffic, especially on rainy nights, could result in death or injury to California tiger salamanders where roads are located in upland habitat.

Impact of Filling the Reservoir

Approximately 306 acres of California tiger salamander upland habitat would be permanently inundated by filling the reservoir to Elevation 756 feet. Most of this habitat is in the grasslands in the southern end of the project area. This area was formerly (1925–2001) inundated by Calaveras Reservoir prior to the DSOD restriction but now consists mostly of grazed non-native grassland that contains small mammal burrows. Flooding could cause death or injury by causing salamanders to leave burrows under unfavorable conditions, exposing them to desiccation and increased predation risk.

Impact Conclusions

The proposed project would directly affect 0.11 acre of aquatic habitat for California tiger salamander at Disposal Site 7. During the construction period, California tiger salamanders could be injured or killed by truck traffic on the haul routes or by other machine operations. Construction of the CDRP would permanently impact 164.6 acres of upland habitat and filling the reservoir would permanently impact 306 acres of upland habitat for a total of 470.6 acres of upland refuge, forage, and dispersal habitat. During construction, the proposed project would temporarily disturb an estimated 30.4 acres of upland refuge, forage and dispersal habitat (see Table 4.4.12). Although upland habitat could be occupied by California tiger salamanders, it is not likely that they are widespread in the project area because of the presence of predators in most potential breeding habitats within 1 mile of the project. However, the loss of aquatic and upland habitat important to the conservation of California tiger salamander and the death or injury of California tiger salamanders in aquatic or upland habitat as a result of construction activities or filling the reservoir are substantial adverse effects and would result in a significant impact. Implementation of Mitigation Measure 5.4.1 would avoid or minimize the potential for death or injury of California tiger salamanders through pre-construction surveys and relocation of

salamanders, and through construction monitoring. Mitigation Measure 5.4.3 requires the SFPUC to compensate for unavoidable temporary and permanent impacts on California tiger salamanders during reservoir filling and construction by enhancing aquatic habitat at the South Calaveras Mitigation Area and by preserving and managing upland refuge, forage, and dispersal habitat at all four mitigation areas. These measures would reduce the impacts of construction and filling the reservoir to a less-than-significant level.

Operation of the dam would annually expose and flood land within the reservoir below Elevation 756 feet. The fluctuating reservoir level would preclude consistent use of this land as refuge and forage habitat and hinder dispersal. Therefore, operation of the dam is not expected to adversely affect California tiger salamander populations in the study area.

Effects of the project are not expected to occur in the extended study area because no salamander habitat would be affected.

Impact 4.4.4: Effect of CDRP on Alameda whipsnake.

Impact of Construction

Table 4.4.13 shows the maximum acreage of Alameda whipsnake habitat that could be affected by the project. In areas where temporary project components, such as haul roads or staging areas, would be inundated after the reservoir is returned to its former level, the impacted acreage is calculated only as an effect of re-filling the reservoir.

Table 4.4.13: Acreage of Alameda Whipsnake Habitat to Be Affected by the Proposed Project

Project Activity	Alameda Whipsnake Habitat to Be Affected (acres) ¹				Timing
	Scrub/Shrub		Woodland/Grassland	Rock Outcrop	
	Diablan Sage	Willow Riparian			
Permanent Construction	25.1	2.6	217.6	11.4	Year 1-Year 4
Temporary Construction	—	—	33.0	0.3	Year 1-Year 4
Re-filling Reservoir	5.2	—	356.3	2.0	1 wet season if wet year, 4 years if “normal” year, 7 years if “dry” years
Note:					
¹ Please see Table 4.4.6 for habitat definitions.					

Source: ETJV unpublished data 2009

Because most of the scrub/shrub habitat for the Alameda whipsnake occurs at the north end of the reservoir, construction activities in this area have the highest potential for direct impacts on the whipsnake. Alameda whipsnake habitat permanently or temporarily lost as a result of construction of the new dam and facilities includes scrub/shrub habitat, which serves as the foundation of home ranges for Alameda whipsnake (USFWS 2006a, p. 58189), woodland and grassland habitat contiguous to scrub/shrub, and rock outcrops. Most of the affected habitat would be disturbed by grading, excavation, and other activities associated with the dam site, Observation Hill, Disposal Site 3, and Borrow Area B. Included in the acreage calculations in Table 4.4.13 are 12.6 acres of designated critical habitat for Alameda whipsnake that could be affected by the CDRP. An estimated 5.3 acres of this designated critical habitat would be permanently affected, and 7.3 acres would be temporarily affected. Only woodland and grassland habitat (i.e., not scrub) is within federally designated critical habitat. Of the 12.6 acres of designated critical habitat, 0.4 acre is paved road, about 2 acres are oak woodland, and about 10 acres are non-native grassland. The paved road does not contain PCEs of critical habitat (USFWS 2005c, p. 60615); therefore, 12.2 acres of critical habitat would be affected by the project. The affected critical habitat is located along a narrow band at the southern margin of designated critical habitat.

Alameda whipsnakes may be killed or injured by haul truck or other construction traffic during grading or excavation at the new dam site or borrow areas, or at disposal sites. Because most of the scrub/shrub habitat for Alameda whipsnake occurs at the north end of the reservoir, construction activities occurring in this area have the highest potential for direct impacts on the Alameda whipsnake. Traffic along the west haul route option has lower potential for killing or injuring whipsnakes because of the limited amount of scrub/shrub habitat along this route. The barge route option has the lowest likelihood of killing or injuring Alameda whipsnakes because the route would avoid most habitat.

The effect of construction disturbance and traffic is difficult to quantify because, although Alameda whipsnakes are presumed to occur in the study area (USFWS 2006a, p. 58195), there is no information on population size or density or movement patterns. However, the loss of any individuals of this threatened species would be a significant impact.

Impacts of Filling the Reservoir

Filling the reservoir would result in the permanent re-inundation of 5.2 acres of scrub/shrub habitat, 2.0 acres of rock outcrop, and 356.3 acres of grassland habitat. Permanent inundation of Alameda whipsnake habitat by filling the reservoir likely does not represent a loss of important habitat for the species because this area was under water from 1925 to 2001. Scrub habitat and other vegetation have become established in the former reservoir inundation area since 2001, so habitat that would be inundated by the proposed project has been available to Alameda whipsnake

for eight years. Scrub/shrub that would be inundated generally has low cover of scrub vegetation. Rock outcrops that would be inundated are generally bedrock that was exposed by DSOD-restricted operation. These outcrops offer few refuges.

Impacts of Operation

Operation of the project is not expected to have a significant impact on Alameda whipsnake habitat. Habitat is unlikely to become established below the 756-foot elevation due to frequent and prolonged inundation. Vehicular traffic could cause the occasional incidental loss of a whipsnake; however, traffic levels associated with operation of the dam would be very low, similar to existing levels.

Impacts on Alameda whipsnake are not expected in the extended study area because the project would not directly or indirectly affect any habitat in that area.

Impact Conclusions

Construction of the proposed project could result in injury or death of Alameda whipsnakes if they are present in the construction area. Because the regional population size of the Alameda whipsnake is not known, this effect is difficult to quantify, but because it is a threatened population, any death or injury of individuals would be significant. Implementation of Mitigation Measure 5.4.1 identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, would reduce this impact to a less-than-significant level by requiring a monitoring and protection plan to avoid and minimize death or injury of Alameda whipsnake through pre-construction surveys and relocation, construction monitoring, and additional restrictions on work within scrub/shrub habitat.

Construction of the proposed project could result in permanent and temporary loss of Alameda whipsnake foraging, dispersal, and breeding habitat. An estimated 24.8 acres of scrub/shrub vegetation (including 2.6 acres of willow riparian) that provides suitable foraging and refuge habitat would be removed during construction. An estimated 5.2 acres of impaired Diablan sage scrub would be permanently inundated by filling the reservoir. Although other vegetation types are commonly used (Alvarez et al. 2005), scrub habitat is the most important vegetation type to Alameda whipsnake (USFWS 2006a, p. 58189). Woodland and grassland vegetation types are regionally abundant (see Figure 4.4.2). Rocky outcrops, especially when located near scrub/shrub habitat, serve important functions for Alameda whipsnake, including providing refuges and foraging opportunities. The loss of 30.0 acres of scrub/shrub habitat and 13.4 acres of rock outcrop as a result of construction and re-filling would be a significant impact on the Alameda whipsnake. Implementation of Mitigation Measure 5.4.3, which requires the SFPUC to compensate for unavoidable temporary and permanent impacts, would reduce this impact to a less-than-significant level by establishing scrub/shrub vegetation in grasslands adjacent to a large

stand of Diablan sage scrub and preserving rocky outcrop habitat at the Sage Canyon Mitigation Area, and by preserving and managing grassland and woodland habitat adjacent to scrub habitat at all four mitigation areas.

Operation of the dam is not expected to affect the Alameda whipsnake.

Impact 4.4.5: Effect of CDRP on callippe silverspot butterfly.

Impacts of Construction

Construction of the proposed project could destroy grasslands that support the larval host plant for callippe silverspot butterfly (johnny jump-up), cause the loss of individuals, and remove nectar plants (e.g., California buckeye, thistle species) used by adults. A small amount (0.57 acre) of grasslands that support johnny jump-up, the sole larval host plant for callippe silverspot butterfly, would be lost north of the existing dam during construction of the staging and access areas near the new dam location. Additional patches of johnny jump-ups in the project area are not expected to be directly affected by construction activities because they are outside the project component footprint. Avoidance of impact by timing construction to avoid a sensitive period is not feasible. Because of the short life span of adults, which emerge and breed within a period of only a few weeks, there is no predictable period during the year when the host plants would not support either newly deposited eggs or larvae at some stage of development. Therefore, direct mortality of callippe silverspot butterfly eggs or larvae could occur if the plants were destroyed. Because the patch of johnny jump-ups that would be affected by the project represents a very small portion of larval habitat for the species in the region (see Figure 4.4.5) and likely does not support the majority of any regional or local breeding population, the overall effect on the regional callippe silverspot population is expected to be small.

Dust generated from construction activities could degrade the quality of habitat by smothering larval host plants. Two areas could be indirectly affected by construction-generated dust. These areas consist of one stand of johnny jump-ups mapped (Entomological Consulting Services 2004b, p. 14) immediately adjacent to the haul road to Disposal Site 7 and another stand mapped (ETJV 2006a) about 640 feet northwest of a staging area for the dam. If these areas are occupied by callippe silverspot butterfly, the extent of this effect would depend on several factors, including numbers of eggs or larvae present, levels of dust emissions, and the direction and strength of prevailing winds.

Callippe silverspot may also be indirectly affected by removal of nectar plants in the project area. Adult silverspot have been observed using buckeye as a nectar source in the canyons and hills north of the existing dam. An estimated 32 acres of upland and riparian oak woodlands, which could support buckeye, would be removed during construction activities. An estimated 27 acres of Diablan sage scrub and 162 acres of grassland, both of which could support mint and thistle

nectar species, would be also be removed by the proposed project. All of these habitats are relatively common in the vicinity of the project area.

Impacts of Filling the Reservoir

Filling the reservoir would not inundate habitat of the callippe silverspot butterfly. Therefore, no impact would occur.

Impacts of Operations

Proposed operation of the reservoir would not affect habitat of the callippe silverspot butterfly. Therefore, no impact would occur.

Impacts on callippe silverspot butterfly are not expected in the extended study area because the project would not directly or indirectly affect any habitat in that area.

Impact Conclusions

As less than an acre of larval host plants would be destroyed during construction of the CDRP, the overall effect on the regional callippe silverspot population is expected to be low. The two stands of johnny jump-ups that would be affected by the project represent a very small fraction of larval habitat for the species in the region (see Figure 4.4.5) and are too small to support a large regional breeding population. However, eggs or larvae of callippe silverspot butterfly could be destroyed during construction of the CDRP; because this is a federally listed endangered species, this would be a significant impact. This significant impact would be reduced to a less-than-significant level by implementation of Mitigation Measures 5.13.1a and 5.13.1b (Air Quality) and 5.9.2a (Hazards and Hazardous Materials), identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, which would require measures to control dust and avoid direct impacts. In addition, Mitigation Measure 5.4.3 requires the SFPUC to compensate for the direct and indirect loss of johnny jump-ups by protecting and enhancing existing grassland habitat containing johnny jump-ups at the South Calaveras and Sage Canyon Mitigation Areas.

The potential loss of some nectar plants in the study area is not likely to have a substantial effect on the population because these plants are found in other grassland and upland woodland habitats that are regionally abundant (see Figure 4.4.2). Therefore, no mitigation for nectar plants is necessary.

Operation of the dam is not expected to affect callippe silverspot. Therefore, no mitigation is necessary.

Impact 4.4.6: Effect of CDRP on bald eagle.

Impacts of Construction

Bald eagles were documented nesting at Calaveras Reservoir starting in 2006, at a territory composed of one active and one alternate nest on the west shore of Calaveras Reservoir. Two chicks hatched in 2006 but did not fledge. In 2007, the eagles constructed a new nest on a power transmission tower about 0.9 mile southeast of the 2006 nest, and more than 1,100 feet from the west shore haul road (Figure 4.4.10) and successfully fledged two chicks. The transmission tower nest was also used in 2008 and 2009. Three artificial bald eagle nest sites were installed between the 2006 and 2007 nests, more than 700 feet from the proposed west shore haul route. No nest trees or structures are expected to be removed by the project, but, under some circumstances, project activities could result in nest failure. Although bald eagles frequently reuse nest sites, they can move nest locations from year to year. Therefore, the potential effects of construction on the nesting pair would depend on the location of an active nest during the construction period.

The proposed Borrow Area E west haul route alternative is within approximately 90 feet of the 2006 nest (and 30 feet from the alternate nest) and more than 1,100 feet from the 2007 nest. Should this haul route option be selected, approximately 240 truck round-trips per day would be needed to transport core and upstream filter material from Borrow Area E in the southern portion of the reservoir to the new dam location (SFPUC 2007b). Haul road construction and traffic is anticipated to occur during two 10-hour shifts per day, 6 days per week. The duration of borrow and fill placement operations is anticipated to be 9 months, from approximately mid-March to mid-December 2009 (SFPUC 2008, C1). If this option is selected, and the 2006 nest is active, construction activities could cause nest abandonment and failure.

The barge haul route is included in the project description as an option to avoid impacts on nesting raptors, especially bald eagles. If the barge haul route option is selected, up to 18 barge round-trips per day would be expected to occur between the north and south ends of Calaveras Reservoir. Barge traffic in the reservoir could deter bald eagles from normal breeding activities at their nest on the Calaveras Reservoir shoreline if barges traveled within 660 feet of the nest. During observations of the nesting eagles in 2006 and 2007, they were not documented foraging on Calaveras Reservoir; however, limited foraging on the reservoir may occur. Barge traffic could deter them from foraging over portions of the reservoir, but this impact is likely to be minimal.

Blasting would be required for excavation for the foundation of the dam, excavation in the west abutment for the spillway, and in Borrow Area B. Blasting could occur almost daily in one or more of these areas during the first 2 years of construction; each blast is anticipated to last less than 2 seconds (SFPUC 2008, C16). No blasting is expected at Borrow Area E as the materials to

be extracted are primarily clayey soils rather than rock. Noise effects can elicit several responses from nesting birds, including eagles. Visible responses can range from agitation; vocalization; and flushing from the nest, resulting in increased exposure of eggs or young to adverse climate or predation, missed feedings, or abandonment of the territory (Knight and Cole 1995, Richardson and Miller 1997). Less obvious responses to noise disturbance can include physiological changes due to stress, such as elevated heart rate and corticosterone production (Youmans 1999, Wingfield and Ramenofsky 1999). All of these responses can result in some degree of increased energy expenditure and/or decreased energy intake for nesting eagles (Knight and Knight 1984, Richardson and Miller 1997, Youmans 1999). Because of the episodic and unpredictable pattern to the proposed blasting, the nesting eagles may not become habituated to the noise (Knight and Cole 1995).

Other ground-disturbing activities, such as excavation of Borrow Area E and placement of materials in Disposal Site 7, are more than 0.5 mile from the bald eagle nest location. Other disposal sites and work areas, as well as potential noise-generating activities including staging areas and access areas, are more than 1 mile from the nest. Thus, activities in these areas are not expected to disturb bald eagles in the currently used nests. Construction lighting (i.e., 24-hour illumination) is also planned to be more than 1 mile away from the bald eagle nest (URS 2006, C18) and therefore is not likely to cause disturbance.

The large workforce in the area also poses a potential concern for harassment of nesting eagles. Eagles are a subject of curiosity and interest to people, and nesting eagles could attract workers on breaks and off hours to the nest. Such visits, even those carried out with sensitivity, could disturb eagles.

The Draft Management Guidelines for Bald Eagle recommend establishing buffers around bald eagle nests to protect them from disturbance (USFWS 2006e). The recommended size of the buffer differs based on the type of activity, the topography, and other ecological characteristics surrounding the nest site. These guidelines recommend a buffer of 1 mile from blasting and other intermittent loud noises in open areas (USFWS 2006a, p. 12). For types of construction activities expected for the proposed project, the guidelines suggest a buffer of 660 feet (USFWS 2006a, p. 11). Blasting would occur more than 1 mile from the nests, and most other ground-disturbing and noise-generating activities would occur more than 0.5 or 1 mile from the existing nests (four to eight times the recommended buffer distance); the exception is the west haul road, which would be within 90 feet of the 2006 nest tree (and 30 feet from the alternate nest), but more than 1,100 feet from the 2007 nest. A few (1-3) bald eagles have been observed using Calaveras Reservoir as wintering habitat in previous years (Bousman, pers. com.). Construction activities, such as truck traffic, blasting, or other ground disturbance, could disturb wintering eagles if they were present. However, Calaveras Reservoir does not support a large wintering population, and other suitable winter foraging and roosting habitat occurs in the region (e.g., undisturbed areas of

Calaveras Reservoir, San Antonio and Del Valle Reservoirs, San Francisco Bay). Therefore, the potential effect of project construction on wintering eagles is expected to be minimal.

Impacts of Filling the Reservoir

Filling the reservoir is not expected to affect bald eagles because no nest structures would be lost, and filling would not require disturbance near any nests. Because the nesting eagles have not been documented foraging on the reservoir, it is unlikely that increasing the size of the reservoir would have a significant impact on bald eagle foraging patterns or foraging success.

Impacts of Operations

Operation of the project is not expected to affect bald eagles because no nest structures would be lost, operations would not require disturbance near any nests, and foraging habitat would not be adversely affected. Impacts on bald eagles are not expected in the extended study area because the project would not directly or indirectly affect any habitat in that area.

Impact Conclusions

Bald eagles could be adversely affected by the CDRP if they nest near construction activities during the construction period. Based on the active and alternative nest locations observed in 2006, the west haul route would be within 30–90 feet of a potential nest tree. If either of the nests in that area is active, construction and use of the west haul road during the breeding season could disrupt normal bald eagle breeding activities, which could result in nest abandonment or failure. This impact would be significant. Mitigation Measure 5.4.1 in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, would reduce impacts to less-than-significant levels by avoiding and minimizing disturbances to nesting bald eagles through establishing buffers around nests and providing a worker education program to inform construction workers of bald eagle protection requirements.

Effects on wintering eagles at Calaveras Reservoir during construction are expected to be minimal as the population is small and other wintering habitat is available in the region, including at Calaveras Reservoir in areas not affected by construction. Filling the reservoir and operation of the dam are not expected to have measurable effects on bald eagle breeding, foraging, or wintering habitat.

Impact 4.4.7: Effect of CDRP on foothill yellow-legged frog.

Impact of Construction

Impacts on the foothill yellow-legged frog during construction of the proposed project would be minimal. Construction activities in potential foothill yellow-legged frog habitat would be

restricted to Calaveras Creek immediately downstream of the existing dam and at the ACDD bypass. The directly affected 945-foot reach of Calaveras Creek within the dam footprint is perennial but does not contain suitable substrate for breeding; it is also impaired by the presence of predatory non-native fish and bullfrogs. Loss of this non-breeding stream habitat would not be significant; no stream habitat at the ACDD bypass would be lost. However, if foothill yellow-legged frogs are present within the work areas during construction of the new dam, spillway, other facilities required for dam operation, and the ACDD bypass, injury or mortality of individuals would be an expected outcome given the substantial amount of earthmoving, operation of mechanical equipment, frequent haul truck movements, human activities, trenching that could trap frogs, etc. Death or injury to individuals of this regionally important species would be a significant impact.

In addition to direct effects on foothill yellow-legged frogs during construction, it is possible that frogs could be killed or injured downstream of construction by discharges of sediment and contaminants that reduce water quality. For example, discharge of contaminants (e.g., fuels, lubricants, naturally occurring metals, etc.) to Alameda or Calaveras Creeks could cause death or injury to individual frogs, which are highly sensitive to toxics in the environment.

Impact of Filling of the Reservoir

Impacts of filling the reservoir would occur by the same mechanisms as described for creeks under California red-legged frogs in Impact 4.4.2. An estimated 9,421 lf of habitat in Arroyo Hondo (Reach AH-1) would be permanently inundated by filling the reservoir. The affected reach of Arroyo Hondo is a low-gradient stream with a cobble substrate that is known to support foothill yellow-legged frog breeding; 27 egg masses were documented in the affected reach in 2007 (ETJV unpublished data 2007). Loss of this breeding habitat could limit the ability of foothill yellow-legged frogs to be self-sustaining, e.g., in response to predation by bullfrogs.

Impacts on the foothill yellow-legged frog in Alameda Creek would be similar to those described under in Impact 4.4.2 for the California red-legged frog. Reduced flows because of the diversion would have the adverse effect of reducing available aquatic habitat compared to some years included in the baseline. Implementation of the 1997 MOU flows with the proposed project would provide minimum flows that would be especially important for maintaining habitat for eggs and tadpoles compared to years in the baseline period when flows have been diverted at ACDD. Minimum flows would provide more water than in baseline years with diversion. Minimum flows would provide less water than in baseline years without diversion; however, minimum flows would maintain habitat availability for the foothill yellow-legged frog in Alameda Creek below ACDD by providing sufficient flow to sustain breeding habitat. This impact would therefore be less than significant, and no mitigation would be necessary.

Impact of Operation

Impacts of operation would occur by the same mechanisms as described for creeks under the California red-legged frog (Impact 4.4.2). Operation of Calaveras Dam would affect the foothill yellow-legged frog habitat in the same four reaches: (1) Calaveras Creek below Calaveras Dam, (2) Alameda Creek between ACDD and the confluence with Calaveras Creek, (3) Alameda Creek from Calaveras Creek to Arroyo de La Laguna, and (4) Alameda Creek in the extended study area.

Implementing bypass flows at the ACDD could improve conditions for foothill yellow-legged frogs in Alameda Creek. Operation of the cone valve outside of the sensitive breeding season and with ramping of non-emergency releases (operations plans proposed as part of the project) would decrease risk of scouring or stranding eggs or tadpoles in Alameda Creek. Although some entrainment could still occur during spillway flows or cone valve use, entrainment would be reduced relative to baseline conditions, so this impact would be less than significant.

Calaveras Creek downstream of the dam would likely experience fewer sustained high-volume flows but would contain more water in the dry season; suitable breeding conditions would likely continue to be limited or lacking, and aquatic habitat for non-breeding life stages would continue to be present. For these reasons this impact is less than significant.

In Alameda Creek from the ACDD to the confluence with Calaveras Creek (Reaches A-3 and A-4), operation of the CDRP would increase dry season flows but reduce wet season flows. Dry season flows would be increased by providing minimum flows established in the MOU (CDFG 1997). This would improve habitat in Alameda Creek by making aquatic habitat more reliably available, annually, during the breeding season. In this reach, Alameda Creek is not impaired by bullfrogs upstream of Little Yosemite.

In Alameda Creek downstream of Calaveras Creek (Reaches A-1 and A-2), minimum flows established in the MOU (CDFG 1997) would provide more reliable suitable hydrologic conditions throughout the breeding period, resulting in less risk of egg or tadpole desiccation and improved aquatic conditions. Although aquatic habitat would be improved, foothill yellow-legged frog reproductive output in these reaches is highly variable and is substantially lower than in an unimpaired reach upstream of the ACDD (Reach A-5) (EBRPD 2007, p. 37). The reasons that reproductive output are variable are not well understood but likely include altered hydrologic conditions resulting from operation of Calaveras Dam (e.g., sustained high flows from use of the cone valve during the breeding season and restricted flows in the dry season), and predation by, or competition with, bullfrogs. Most of the reproductively successful drainages within the EBRPD (which includes Alameda Creek) are relatively free of bullfrogs and non-native fish (EBRPD 2007, p. 30). An increase in the amount of perennial creek habitat in Alameda Creek downstream of the confluence with Calaveras Creek would also improve habitat for bullfrogs.

Bullfrogs are common in this reach and could become more abundant, potentially increasing the risk of predation on or competition with the foothill yellow-legged frog in this reach.

As described under impacts on the California red-legged frog in the extended study area, predicted changes in the flow regime could result in small changes in habitat conditions in lower Alameda Creek; however, these potential changes would be diminished by operations of other water resource management entities in the watersheds that supply Arroyo de la Laguna and would not be expected to result in changes that would exacerbate current habitat conditions in lower Alameda Creek for the foothill yellow-legged frog. Therefore, impacts in the extended study area are less than significant.

Impact Conclusions

Construction of the dam and spillway could result in a loss of foothill yellow-legged frogs; this is a Species of Special Concern that is regionally important, and the loss of individuals would be a significant environmental impact. Indirect effects of construction could include a reduction in water quality from erosion or spills of fuel or other hazardous materials during construction. These would be significant impacts. Mitigation Measures 5.4.1 and 5.7.1, identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, would reduce these impacts to less-than-significant levels by requiring pre-construction avoidance and minimization measures and preventing water quality degradation.

Filling the reservoir would reduce available breeding habitat in Arroyo Hondo by 9,421 lf; this impact would be a substantial loss of breeding habitat, which would be a significant impact on this sensitive species. The implementation of the 1997 MOU flows with the proposed project would provide minimum flows in Alameda Creek between the ACDD and Calaveras Creek, which would be especially important for maintaining habitat for eggs and tadpoles. Compared to the baseline, minimum flows would provide more reliable water during the breeding season. Minimum flows would provide less water than under baseline years without diversion; however, they would maintain habitat availability for the foothill yellow-legged frog in Alameda Creek downstream of the ACDD (Reaches A-3 and A-4) by providing sufficient flow to sustain breeding habitat on an annual basis in a reach that is unimpaired by bullfrogs. Minimum flows will also increase the amount and reliability of perennial aquatic habitat for foothill yellow-legged frogs and bullfrogs in Alameda Creek downstream of the confluence with Calaveras Creek (Reaches A-1 and A-2) and so could increase predation and competition pressure on foothill yellow-legged frogs in those reaches. If predation and/or competition from bullfrogs increases to such an extent that the foothill yellow-legged frog population is substantially reduced, this would be a significant impact. Improvements to foothill yellow-legged frog breeding habitat in Alameda Creek from the ACDD to the confluence with Calaveras Creek (Reaches A-3 and A-4) are expected to offset the loss of breeding habitat in Arroyo Hondo (Reach AH-1); however, until

bypass flows begin, the extent of improvements cannot be known and cannot be compared to the impact on Arroyo Hondo. Likewise, the extent of potentially increased predation and competition by bullfrogs in Alameda Creek downstream of the confluence with Calaveras Creek cannot be known until bypass flows begin. Therefore, Mitigation Measure 5.4.3 requires the development and implementation of a monitoring program with ecologically based success criteria to determine whether the compensation objectives for foothill yellow-legged frog are achieved and requires adaptive management measures if necessary to ensure that the loss of foothill yellow-legged frog breeding habitat is fully compensated. With the implementation of Mitigation Measure 5.4.3, this impact would be less than significant.

Operation of the replacement dam, reservoir, and ACDD would maintain foothill yellow-legged frog habitat in Alameda Creek between the ACDD and Calaveras Creek.

Timing of releases through the cone valve would be restricted to the least sensitive periods to the maximum extent feasible, and non-emergency releases will be ramped, resulting in a reduction of stranding eggs or scouring eggs, tadpoles, or adults downstream. As a result of the cone valve operations plan included as part of the project, this impact would be less than significant.

Because predicted changes in the flow regime and associated changes in habitat conditions in lower Alameda Creek would be relatively small and would be diminished by operations of other water resource entities in the Arroyo de la Laguna watershed, operation of the proposed CDRP would not be expected to result in significant changes to habitat conditions in the extended study area. This impact would be less than significant.

Impact 4.4.8: Effect of CDRP on Heermann's kangaroo rat.

Impact of Construction

Although the CDRP study area contains potentially suitable habitat for Heermann's kangaroo rat, which could be the Berkeley kangaroo rat subspecies, no kangaroo rats were detected during focused surveys under close advisement with CDFG in 2007 (ETJV 2007b). Because no Heermann's kangaroo rat were found, the study area for CDRP is considered to be unoccupied by Heermann's kangaroo rat, and no impacts are anticipated.

Impact of Filling of the Reservoir and Operations

Filling and operation of the reservoir are not expected to result in impacts on the Berkeley kangaroo rat or its habitat. Impacts on Berkeley kangaroo rats are not expected in the extended study area because the project would not directly or indirectly affect any habitat in that area.

Impact Conclusions

The CDRP is not expected to result in loss of potential Heermann's kangaroo rat habitat or direct mortality of Heermann's kangaroo rat.

Impact 4.4.9: Effect of CDRP on other special-status species.

A total of 25 animals that are not listed as threatened or endangered but that meet the definition of special-status species as defined by CEQA are known or expected to occur on the project site (Appendix C.1). Many of these species would not be substantially affected by the project. However, impacts may occur on western pond turtle, nesting raptors, and upland special-status species (silvery legless lizard, California horned lizard, loggerhead shrike, grasshopper sparrow, tricolored blackbird,¹¹ Townsend's big-eared bat, pallid bat, western mastiff bat, and American badger). These potential impacts are discussed below.

Impact 4.4.9a: Effect of CDRP on western pond turtle.

Impact of Construction

Construction of the project could result in the mortality of western pond turtle in Calaveras Creek, Alameda Creek, and one pond, and the permanent loss of aquatic habitat in Calaveras Creek and one pond. Construction impacts on aquatic habitat would occur by the same mechanisms described in detail in Impact 4.4.2 (California red-legged frog). The proposed project would result in the permanent loss of 945 lf of Calaveras Creek and 0.11 acre of pond habitat. Construction activities could injure or kill western pond turtles if they become trapped in the work area with no escape route. Construction impacts on individuals would therefore be significant.

Impact of Filling of the Reservoir

Filling the reservoir would increase reservoir shoreline habitat (used by western pond turtle) from 14.8 miles to 25.8 miles. Perennial ponds and creeks and Calaveras Reservoir shoreline habitat all provide for foraging, thermoregulation, and avoidance of predators by western pond turtle and are all equally considered "core" habitat by the draft AWHCP for the purpose of habitat modeling (Jones & Stokes 2006).

¹¹ Tricolored blackbirds are most often considered a marsh-nesting species, but they also nest and forage in uplands under some conditions. No suitable wetland nesting habitat for tricolored blackbird occurs in the study area, so for the purpose of this analysis this species is treated as an upland-associated species.

Impact of Operation

Operation impacts on flows in Calaveras and Alameda Creeks are described in detail above under Impact 4.4.2. Operation of the replacement dam, reservoir, and ACDD would maintain western pond turtle aquatic habitat in Alameda Creek between the ACDD and Calaveras Creek (Reaches A-3 and A-4). The implementation of the 1997 MOU flows under the proposed project would provide minimum flows in Alameda Creek between the ACDD and Calaveras Creek and downstream reaches (Reaches A-1 and A-2), which would provide aquatic habitat more regularly on an annual basis compared to existing conditions.

As described under impacts on the California red-legged frog in the extended study area, predicted changes in the flow regime could result in small changes in habitat conditions in lower Alameda Creek; however, these potential changes would be diminished by operations of other water resource management entities in the watersheds that supply Arroyo de la Laguna and would not be expected to result in changes to habitat conditions in lower Alameda Creek for the western pond turtle. Therefore, impacts in the extended study area would be less than significant.

Impact Conclusions

Construction of the CDRP and its mitigation could result in death or injury of western pond turtles. This impact is significant and would be mitigated to less-than-significant levels with implementation of Mitigation Measure 5.4.1, identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project. This measure avoids impacts by removing western pond turtles from construction areas and providing worker training. The substantial increase in the amount of shoreline habitat (by 11 miles) when the reservoir is re-filled would compensate for loss of pond and creek habitat in Calaveras Creek and Arroyo Hondo; therefore, impacts from re-filling would be less than significant. Operation of the project would not substantially change western pond turtle aquatic habitat in Alameda and Calaveras Creeks; therefore, operation of the project would have a less-than-significant impact.

Impact 4.4.9b: Effect of CDRP on nesting raptors.

Impacts of Construction

The study area contains suitable nesting habitat for both tree- and ground-nesting raptors. Tree-nesting raptors, such as golden eagle, white-tailed kite, and Cooper's hawk (*Accipiter cooperii*), may use upland and riparian forest for nesting. Northern harrier and burrowing owl may use grasslands in the study area for nesting although they have not been observed during breeding raptor surveys. Additionally, burrowing owls are uncommon breeders in the region, and there is a low likelihood that they nest in the project area (Center for Biological Diversity 2003).

Construction of the proposed project, including construction of haul routes and blasting, could result in direct mortality of eggs or young raptors, including golden eagle, white tailed kite, northern harrier, and burrowing owl, if active nests are destroyed or abandoned as a result of disturbance by noise, vehicles, foot traffic, or other mechanisms during construction. This impact is similar in kind to that discussed under Impact 4.4.6 for the bald eagle. This impact would be a significant environmental effect.

Impacts of Filling the Reservoir

Filling the reservoir could flood the nests of ground-nesting raptors (i.e., northern harrier, burrowing owl) in grasslands below the 756-foot inundation elevation. The extent of this impact would depend on whether active nests are present when the reservoir is filled. Northern harriers have been observed foraging in the project area, and habitat is suitable for northern harriers and burrowing owls to nest there. No northern harriers or burrowing owls were observed breeding in the project area during raptor surveys conducted in 2006 and 2007. Most of the reservoir filling would occur from October through March, depending on rainfall. The latter portion of the filling period partially overlaps with the typical raptor nesting period, March through August. Because northern harriers and burrowing owls have not been documented breeding in grasslands that would be inundated, there is a low likelihood for nests to be flooded. However, if active nests were present and flooded, this would result in the removal of active nests and possibly in the death of adult burrowing owls that could be trapped in burrows as they flooded. This would be a significant impact.

Impacts of Operation

Operation of the CDRP would not substantially change from baseline operations with respect to raptor nesting habitat.

Impact Conclusions

Construction of the CDRP and re-filling of the reservoir could result in the direct mortality of raptors, and this impact would be significant. This impact would be mitigated to less than significant with implementation of Mitigation Measure 5.4.1, identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, which requires pre-construction surveys and nest avoidance or possible relocation of at-risk eggs or young to an appropriate wildlife care facility during construction and reservoir filling.

Impact 4.4.9c: Effect of CDRP on upland Species of Special Concern, bats, and migratory birds.

The study area contains potentially suitable habitat for silvery legless lizard, California horned lizard, loggerhead shrike, grasshopper sparrow, tricolored blackbird, Townsend's big-eared bat,

pallid bat, western mastiff bat, and American badger, as well as numerous bird species protected by the MBTA. These species could be affected by disturbance and loss of habitat during construction of the CDRP and filling the reservoir.

Impacts of Construction

Construction of the proposed project could result in the loss of habitat that might be used by silvery legless lizard, California horned lizard, loggerhead shrike, grasshopper sparrow, tricolored blackbird, Townsend's big-eared bat, pallid bat, western mastiff bat, and American badger, as well as numerous bird species protected by the MBTA. Table 4.4.14 shows habitats important to each species, and Table 4.4.15 shows the number of acres of habitat that would be removed by the proposed project. Construction could also cause the disturbance or removal of active special-status bird nests or bat maternity sites through disturbance from noise, vehicles, foot traffic, or other mechanisms.

Impact of Filling of the Reservoir

Filling the reservoir would inundate habitat used by these species. The amount of each habitat type used by these species that would be inundated is shown in Table 4.4.15.

Impact of Operation

Operation of the CDRP would not cause the loss of substantial habitat beyond that associated with construction in the study area or extended study area (see Impact 4.4.11 for a discussion of impacts on riparian habitat in the extended study area).

Impact Conclusions

Construction could result in the loss of habitat for special-status species and bird species protected by the MBTA. Construction could also cause the disturbance or removal of active special-status bird nests or bat maternity sites. These impacts of construction would be significant. The loss of habitat during re-filling of the reservoir is also a significant impact. Operation of the project would not introduce new disturbances or cause the loss of additional habitat and would therefore not have a significant impact. Mitigation Measure 5.4.1, identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, would reduce impacts to less-than-significant levels by minimizing habitat impacts, requiring pre-construction bird nest and bat roost surveys, and ensuring avoidance of active nests and roosts. Mitigation Measure 5.4.3 requires the SFPUC to compensate for unavoidable impacts of habitat loss during reservoir filling and construction by preserving and managing habitat for upland species of concern, bats, and migratory birds in the South Calaveras, San Antonio, Sage Canyon and Goat Rock Mitigation Areas.

Table 4.4.14: Habitat Associations of Upland Special-Status Species

Species	Habitat Types Used						
	Grassland	Scrub	Upland Woodland	Riparian Forest	Wetland	Rock Outcrop	Developed
Reptiles and Amphibians							
Silvery legless lizard		X	X	X			
California horned lizard		X	X	X			
Birds							
Loggerhead shrike	X	X	X				
Grasshopper sparrow	X						
Tricolored blackbird	X				X		
Other birds protected by the MBTA	X	X	X	X	X	X	X
Mammals							
Townsend's big-eared bat				X		X	X
Pallid bat			X	X		X	X
Western mastiff bat				X		X	X
American badger	X	X	X				
<i>Note:</i> MBTA – Migratory Bird Treaty Act							

Source: ETJV unpublished data 2009

Table 4.4.15: Upland Special-Status Species Habitat Construction Impacts

General Habitat Type	Vegetation Community	Permanent Impact Acres (Linear Feet)		Temporary Impact ³ Acres (Linear Feet)
		Project Footprint ¹	Inundated ²	
Upland Woodland ⁴	Valley Oak Woodland	0.9	—	—
	Oak Savannah	2.2	—	—
	Mixed Evergreen Forest/Oak Woodland	20.9	—	—
Riparian Forest ⁴	Central Coast Live Oak Riparian Forest	1.3	—	—
	Coast Live Oak Riparian Forest	4.0	—	—
	Willow Riparian Forest	2.6	—	—
Scrub	Coyote Brush Scrub	—	21.1	—
	Diablan Sage Scrub	25.1	5.2	—
Grassland	Non-Native Grassland	159.0 ⁵	259.4	26.7
	Serpentine Bunchgrass Grassland	13.6	—	—
Rock Outcrop	Unvegetated	11.4	2.0	0.3
Disturbed	Unvegetated	20.1	72.2	0.4
Developed	Unvegetated or Landscaped	9.4	0.1	2.7
Notes: ¹ Includes all permanent impacts even if they would be inundated by restoring the reservoir level. ² Includes temporary impacts that would be inundated by restoring the reservoir level. ³ Includes only temporary impacts of project components that would not be inundated by restoring the reservoir level. ⁴ Temporary impacts are considered permanent because regeneration of these communities could take more than 5 years. ⁵ Permanent impacts would be reduced by 1 acre if the Borrow Area E barge haul option is used instead of the west shore haul road.				

Sources: ETJV 2006a; URS 2008d; ETJV unpublished data 2009

Impact 4.4.10: Effect of CDRP on special-status plant species.

Impacts of Construction

Construction of the CDRP would not result in the disturbance or loss of mapped populations of most beautiful jewel-flower or Diablo helianthella. No construction activities are proposed in the location where Diablo helianthella was identified. Disposal Site 7 is proposed within 20-40 feet south and west of where most beautiful jewel-flower was identified during 2006 botanical surveys (ETJV 2006a). Although construction is not planned within mapped populations, it is close enough that the populations could be inadvertently impacted (e.g., if construction crews park vehicles or machinery adjacent to their work area). Disturbance or loss of individual most beautiful jewel-flowers would be a significant impact.

Impacts of Filling the Reservoir and Operations

Filling and operation of the CDRP would have no impact on most beautiful jewel-flower.

No impacts on special-status plant species are expected in the extended study area because the project would not affect any habitat that supports these species.

Impact Conclusions

Construction could result in the accidental loss of most beautiful jewel-flower plants, which would be a significant impact. Mitigation Measure 5.4.1, identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, would reduce this impact to a less-than-significant level by requiring barrier fencing and informational signage to prevent inadvertent impacts on populations near construction activities.

Impact 4.4.11: Effect of CDRP on sensitive vegetation communities.

In addition to potential impacts on special-status plant species identified above, the CDRP could affect other sensitive vegetation communities. Sensitive vegetation communities that could be affected by the CDRP include oak woodlands, riparian forest, serpentine grassland, wetlands, and streams. Please see Impact 4.4.1 for a discussion of impacts on wetlands and streams.

Impacts of Construction

Sensitive natural communities in the study area include oak woodlands (blue oak woodland, valley oak woodland, oak savannah, and mixed evergreen forest/oak woodland), riparian forest (willow riparian forest, coast live oak riparian, central coast live oak riparian), and serpentine grassland. The project has been designed to minimize impacts on sensitive communities but has not been able to completely avoid them. See Table 4.4.16 for the acreage of oak woodlands, riparian forest, and serpentine grasslands that would be removed by construction of the CDRP

and flooded by filling of the reservoir (please note that Table 4.4.16 repeats some of the information already presented in Table 4.4.15).

Table 4.4.16: Sensitive Natural Community Impacts¹

Sensitive Natural Community	Vegetation Community	Acres² Permanently Lost to Construction	Acres² Temporarily Lost to Construction	Acres² Lost to Inundation
Upland Woodland ²	Valley Oak Woodland	0.9	–	–
	Oak Savannah	2.2		
	Mixed Evergreen Forest/Oak Woodland	20.9	–	–
Riparian Forest	Central Coast Live Oak Riparian Forest	1.3	–	–
	Coast Live Oak Riparian Forest	4.0	–	–
	Willow Riparian Forest	2.6	0	–
Serpentine Grassland	Serpentine Grassland	13.6	–	–
Notes: ¹ These impacts have been presented in previous tables but are repeated here to summarize impacts on sensitive communities. ² Waters of the United States were mapped to the nearest 0.01 acre and are presented to the nearest 0.01 acre; other habitats were mapped to the nearest 0.25 acre and are presented rounded to the nearest acre.				

Source: ETJV unpublished data 2009

The loss of upland oak woodlands would occur primarily in the vicinity of the dam and Disposal Sites 3 and 7; riparian oak habitat would be lost on moist slopes between the dam and Disposal Site 7. Up to 29.3 acres of upland and riparian oak woodlands and savannah would be affected by the CDRP (ETJV 2008). Table 4.4.17 summarizes the number of trees and total dbh, by species, that could be lost as a result of the project. The loss of up to 29.3 acres of oak habitat and 29 “isolated” oak trees is a significant impact.

Riparian willow habitat would be lost at the foot of the dam. Serpentine grasslands would be lost on the northeast side of the reservoir as a result of use of Disposal Site 7. The loss of 2.6 acres of riparian willow habitat and 13.6 acres of serpentine grasslands would be a significant environmental impact.

Table 4.4.17: Individual Oak Trees Affected by the CDRP

Name	DBH (inches)	Number of Stems
Blue oak (<i>Quercus douglasii</i>)	20	1
	18	2
	18	1
	14	1
	8	1
Blue Oak Subtotal	78	
Coast live oak (<i>Quercus agrifolia</i>)	61	1
	51	4
	49	1
	39	2
	34	3
	33	1
	30	3
	28	1
	24	2
	23	1
	18	1
	16	1
	15	1
	12	4
	11	1
	9	1
Coast Live Oak Subtotal	453	
Valley oak (<i>Quercus lobata</i>)	60	2
	58	2
	56	1
	43	1
	41	1
	30	1
	26	1
	12	1
Valley Oak Subtotal	326	
Total	857	

Source: ETJV 2008

Impacts of Filling the Reservoir

Filling the reservoir would not affect any sensitive natural communities.

Impacts of Operation

Impacts on riparian vegetation from operation of the project are discussed under “Impacts of Operation” in Impact 4.4.1: Effect of CDRP on wetlands and other aquatic habitats. Operation of the project would result in less-than-significant impacts on riparian vegetation.

Impact Conclusions

Construction of the CDRP would cause the loss of oak woodlands and savannah, riparian forest, and serpentine grasslands, which would be a significant impact. Re-filling of the reservoir and operation of the project would not cause significant impacts on sensitive natural communities. The impact of construction would be reduced to less-than-significant levels by implementation of Mitigation Measure 5.4.3, identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, which would compensate for habitat losses by creating, restoring, and enhancing oak woodlands and savannah at the San Antonio Mitigation Area, riparian forest at the South Calaveras and San Antonio Mitigation Areas, and enhancing and protecting serpentine grasslands at the Goat Rock Mitigation Area.

Impact 4.4.12: Effect of CDRP on local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

The CDRP is located on CCSF lands within Alameda and Santa Clara Counties. The line dividing Alameda and Santa Clara Counties runs east to west through the northern portion of the Calaveras Dam and Reservoir. The proposed replacement dam and much of the project construction activity would be on the northern portion of the project site, on SFPUC lands located in eastern Alameda County. Borrow Area E, Disposal Site 5, access roads, and biological mitigation areas would be located on SFPUC lands in Santa Clara County. Most of the Calaveras Creek and Alameda Creek watersheds that supply Calaveras Reservoir are also in Santa Clara County.

During construction of the CDRP, the use of Calaveras Road and existing local access roads within the SFPUC-owned portion of the watershed would not result in the removal or pruning of trees. The removal of protected trees from locations proposed for disposal sites, borrow areas, or temporary project-related roads would not occur on property owned or leased by Santa Clara County or Alameda County. In addition, there are no Santa Clara County-designated heritage trees on SFPUC-owned watershed lands. Therefore, the CDRP would not result in the removal of any trees protected under the tree ordinances of Santa Clara or Alameda Counties and there is no potential for conflict with these ordinances.

Impact Conclusion

The construction of the CDRP and the use of Calaveras Road and other roads within the SFPUC-owned portion of the watershed would not result in a conflict with strategies, goals, policies, or specific ordinances applicable to adjacent county lands that are intended to protect unique biological resources and habitats. The CDRP is designed to avoid impacts on biological resources to the extent feasible and to mitigate unavoidable impacts. Through compliance with federal and state regulations protecting biological resources, and implementation of Mitigation Measures 5.4.1, 5.4.2, 5.4.3, and 5.7.1 identified in Chapter 5, Mitigation Measures Proposed to Minimize Potentially Significant Adverse Impacts of the Project, potential impacts of the CDRP that could conflict with Alameda and Santa Clara County policies and ordinances protecting biological resources would be less-than-significant.

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4.5 FISHERIES AND AQUATIC HABITAT

Section 4.5 Contents	
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4.5.2.2	Approach to Analysis
4.5.2.3	Project Impacts

This section of the Environmental Impact Report (EIR) addresses fisheries resources in the project study area. Terrestrial biological resources, including other aquatic resources, are addressed in Section 4.4, Vegetation and Wildlife. Hydrology and geomorphology are addressed in Section 4.6, Hydrology, and water quality is addressed in Section 4.7, Water Quality.

The Alameda Creek watershed historically contained populations of anadromous steelhead and resident rainbow trout. As described below, water supply projects, gravel mining, urban development, and flood control modifications have resulted in altered habitat and reduced this historical fishery; however, populations of these and other fish species still inhabit certain reaches of Alameda Creek and its tributaries, including those found in the project study areas.

This section contains a synthesis of both existing information and new information related to fisheries resources in the project area. This assessment is based on data collected by the San Francisco Public Utilities Commission (SFPUC) as part of ongoing upper Alameda Creek watershed fisheries studies initiated in 1998, as well as fisheries data collected as part of the environmental review for the Calaveras Dam Replacement Project (CDRP).

The following analysis is based on information from existing reports and databases and additional field investigations conducted for this EIR. The investigations specifically included an evaluation of streamflows to support spawning rainbow trout and steelhead (*Oncorhynchus mykiss*) in Alameda Creek; an evaluation of water temperatures at specific locations in Arroyo Hondo and Alameda Creek; and evaluations of aquatic habitat conditions in Calaveras Creek upstream of Calaveras Reservoir, in Alameda Creek upstream of Camp Ohlone, and in Arroyo Hondo upstream of the large landslide. The results of these additional investigations were incorporated into a technical report, *Calaveras Dam Replacement Project, Fisheries Technical Report* (ETJV 2008). Information from the technical report has been summarized and is presented below.

Hydrological data for the CDRP are analyzed to provide additional information on streamflows to support analysis of the proposed project's potential effects on hydrology, geomorphology, and fisheries resources. The results of these analyses are provided in Section 4.6, Hydrology, and are referenced herein.

STUDY AREAS

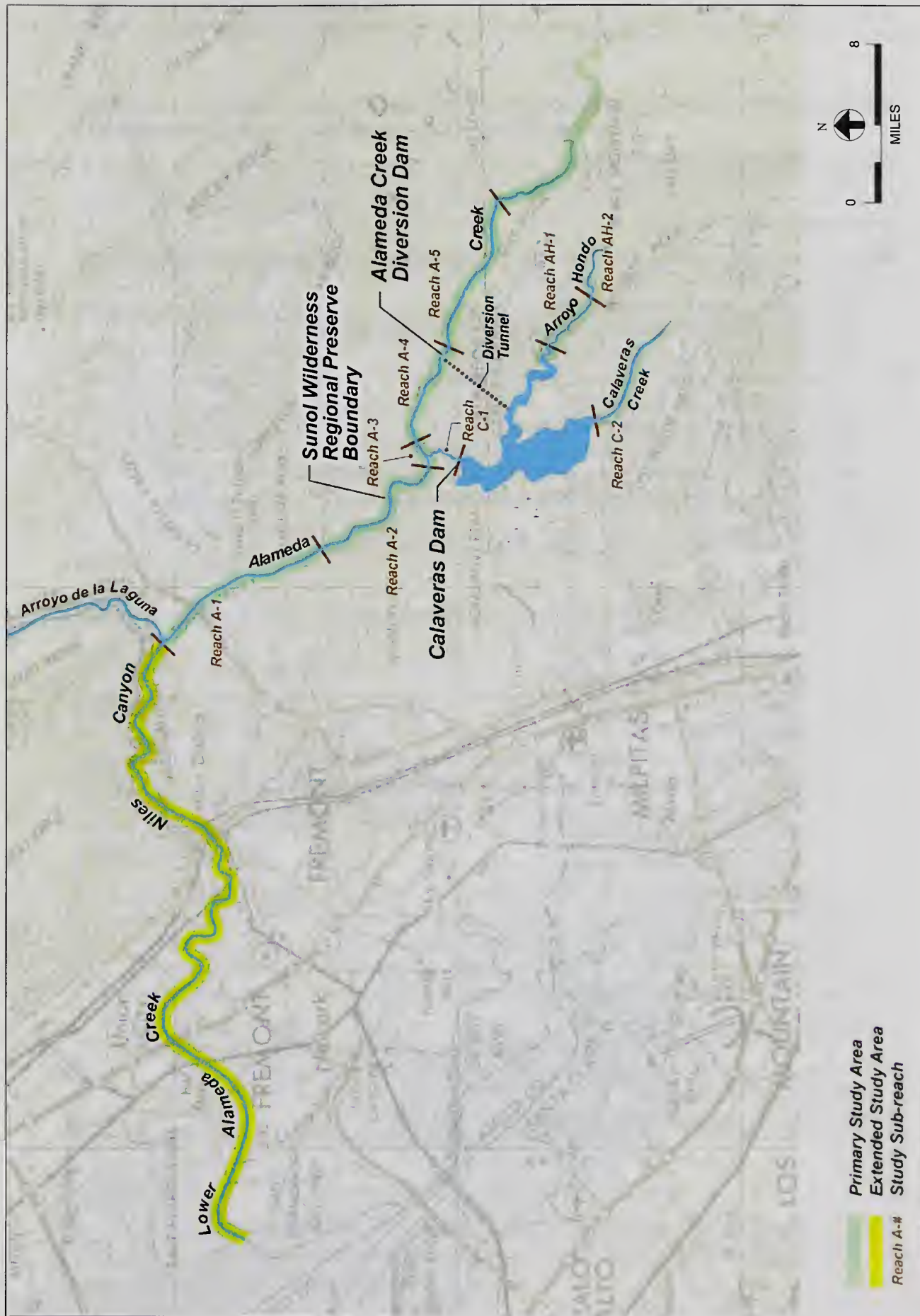
For purposes of analysis of fisheries resources, two discrete study areas have been identified, a primary area and an extended study area (see Figure 4.5.1: Fisheries and Aquatic Habitat Study Areas). They consist of all aquatic habitats that could be directly or indirectly affected by the construction and operation of the proposed dam and associated facilities.

Primary Study Area

Stream reaches downstream of Calaveras Dam and the Alameda Creek Diversion Dam (ACDD) could be most affected by operation of the proposed project and are therefore included in the primary study area. This area includes Calaveras Creek from the existing dam downstream to the confluence with Alameda Creek and Alameda Creek downstream from the existing ACDD to Arroyo de la Laguna. The ACDD diverts water from upper Alameda Creek to Calaveras Reservoir and is an integral part of the existing and proposed project operations. The ACDD is located on upper Alameda Creek approximately 3 miles upstream from the Calaveras Creek confluence. Upstream of the ACDD, Alameda Creek is considered hydrologically unimpaired. Downstream of Calaveras Dam, the primary study area includes the segment of Alameda Creek terminating at the Arroyo de la Laguna confluence. The primary study area also includes the Calaveras Reservoir impoundment area, which encompasses the area that would be directly affected by restoring the pool elevation of the reservoir after construction of the replacement dam and portions of tributaries (e.g., Arroyo Hondo, upper Calaveras Creek) that could be inundated when the reservoir is at maximum capacity, but would otherwise not be altered during construction.

Extended Study Area

The extended study area includes the segment of the Alameda Creek main stem from the Arroyo de la Laguna confluence downstream to San Francisco Bay. Streamflows and the related fisheries habitat conditions in the extended study area are strongly influenced by operation of other water projects in the watershed including Del Valle Reservoir and water deliveries to the Alameda County Water District (ACWD) from the South Bay Aqueduct via Vallecitos Creek, which enters Arroyo de la Laguna just upstream of the Alameda Creek confluence. While operation of Calaveras Reservoir and the ACDD influences flow conditions in Alameda Creek in the extended study area, it is difficult to distinguish this influence from the effects of these other water projects.



SOURCE: ED&J & Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.5.1: FISHERIES AND AQUATIC HABITAT STUDY AREAS

4.5.1 SETTING

4.5.1.1 EXISTING CONDITIONS

Subsection 4.5.1.1 Contents

Regional and Local Agreements, Plans, and Groups Relevant to the Protection of Fisheries Resources in the Alameda Creek Watershed

- 1991 SFPUC Memorandum to CDFG

- 1997 CDFG and SFPUC Memorandum of Understanding (MOU)

- Alameda Creek Fisheries Restoration Workgroup

 - Steelhead Population Restoration Assessment

 - Steelhead Flow Studies MOU

- SFPUC Alameda Watershed Management Plan

- SFPUC Alameda Watershed Habitat Conservation Plan

- SFPUC Water Enterprise Environmental Stewardship Policy

- SFPUC Watershed and Environmental Improvement Program

Aquatic Habitats

- Past and Present Projects Affecting Aquatic Habitat Conditions

- Primary Study Area

 - Stream Study Reaches

 - Reach A-1 (Alameda Creek)

 - Reach A-2 (Alameda Creek)

 - Reach A-3 (Alameda Creek)

 - Reach A-4 (Alameda Creek)

 - Reach A-5 (Alameda Creek)

 - Reach A-6 (Alameda Creek – Upstream of Camp Ohlone)

 - Reach C-1 (Calaveras Creek – Downstream of Calaveras Reservoir)

 - Reach C-2 (Calaveras Creek – Upstream of Calaveras Reservoir)

 - Reach AH-1 (Arroyo Hondo)

 - Reach AH-2 (Arroyo Hondo)

 - Calaveras Reservoir

- Extended Study Area

 - Lower Alameda Creek

 - Niles Canyon

Fish Species and Aquatic Communities

- Stream Fish Communities

 - Species Occurrence, Distribution, and Relative Abundance in the Primary Study Area

 - Primary Factors Limiting Fish Populations in the Primary Study Area

- Benthic Macroinvertebrates

- Calaveras Reservoir Fish Communities

Regional and Local Agreements, Plans, and Groups Relevant to the Protection of Fisheries Resources in the Alameda Creek Watershed

The following agreements and plans are applicable to the environmental setting for the CDRP or provide useful background information.

1991 SFPUC Memorandum to CDFG

The SFPUC prepared and delivered a memorandum to the California Department of Fish and Game (CDFG) (dated October 11, 1991) addressing the design and operation of fish screens at the Calaveras Reservoir intake for the Sunol Valley Water Treatment Plant (SVWTP) (SFPUC 1991). The memorandum specifies screen materials, mesh size, and screen configuration for the two uppermost adits and operating characteristics including design approach velocity and slot velocity under normal operating, design capacity, and emergency releases. In addition, the memorandum assumes that Calaveras Reservoir will be operated to minimize potential hazard to juvenile fish populations by recognition of critical seasonal periods, operating levels, and screen approach velocities.

1997 CDFG and SFPUC Memorandum of Understanding (MOU)

A 1997 MOU between the SFPUC and CDFG specifies releases from Calaveras Reservoir to improve habitat conditions for native rainbow trout and native warm-water fish species. Flow releases have been designed to provide water at temperatures that are cold enough for rainbow trout in a defined upper study reach, yet with sufficient warming to satisfy the temperature requirements of native, warm-water fishes in a defined lower reach (CDFG 1997). The flow regimes at the point of compliance (the confluence of Alameda and Calaveras Creeks) are as follows (CDFG 1997):

- From November 1 through January 12, the minimum flow would be 4.5 cubic feet per second (cfs) with a 5-day running average flow of 5 cfs. On January 13 and 14, following the “ramping” schedule stipulated by the MOU, the flow would be greatly increased, until on January 15, the minimum flow would be 18 cfs with a 5-day running average of 20 cfs. This flow rate would continue without change until March 15.
- Beginning on March 16, following the ramping schedule given in the MOU, the flow would be reduced in a series of steps occurring over the next month.
- Finally, on April 5, minimum flow would reach 6.3 cfs with a 5-day running average of 7 cfs. The flow would remain at that level until the end of the following October (except as modified with the ramping schedule).

Additionally:

- The SFPUC shall also maintain existing base flow conditions in Calaveras Creek above its confluence with Alameda Creek. These flows consist of approximately 0.5 cfs of seepage from Calaveras Dam.

Additional elements of the 1997 MOU include (CDFG 1997):

- Reservoir management: The SFPUC shall maintain historical Calaveras Reservoir stratification conditions. The SFPUC shall monitor conditions to ensure that favorable water temperatures for fish releases are maintained. The SFPUC may reduce spawning and rearing flows in order to preserve cold-water releases from Calaveras Reservoir throughout the summer, after consulting with, and obtaining the approval of, CDFG.
- Monitoring program: The monitoring program includes water quality (stream and reservoir), water quantity (stream and reservoir), and biology (fish populations, spawning, and habitat) parameters.
- Adjustment of flows during 5-year monitoring period (i.e., adaptive management).
- Adjustment of water releases and storage levels due to emergencies and scheduled maintenance.
- Construction of downstream facilities to recapture the water released for the proposed fishery and aquatic habitat beneficial uses.

The SFPUC has initiated the monitoring program; however, it has not yet begun the program of releases due to delays in constructing a water recapture facility and water storage restrictions placed on Calaveras Dam by the DWR Division of Safety of Dams (DSOD) due to concerns regarding the seismic safety of Calaveras Dam. It is expected that the MOU will provide the foundation for supporting fish communities downstream of Calaveras Reservoir, as well as downstream of the ACDD with current proposed bypass flow operations at that location. The geographic area covered by the MOU includes Calaveras Reservoir, Calaveras Creek between Calaveras Dam and the confluence of Calaveras and Alameda Creeks, and Alameda Creek between the ACDD and the previously proposed point of water recapture facility in the vicinity of the SVWTP. (The proposed location and type of recapture is currently under re-evaluation as part of a separate Water System Improvement Program (WSIP) project referred to in the WSIP Program EIR as the Alameda Creek Fisheries Enhancement Project but currently known as the Upper Alameda Creek Filter Gallery Project.) A full discussion of the operational requirements specified in the MOU and low-flow (environmental) valve configuration also is provided in Section 3.6, Project Operation, in Chapter 3, Project Description.

Alameda Creek Fisheries Restoration Workgroup

The Alameda Creek Fisheries Restoration Workgroup (ACFRW) is a multi-agency stakeholder group formed in 1999 to develop and implement a strategy to restore steelhead trout to Alameda Creek. The ACFRW is composed of numerous community and citizens' groups, local water management and flood control agencies, state and federal resource agencies, and others.

Steelhead Population Restoration Assessment

With funding from the Alameda County Flood Control and Water Conservation District (ACFCWCD), the California State Coastal Conservancy, and the SFPUC, the ACFRW published

a report entitled *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed* in February 2000 (Gunther et al. 2000). The assessment found that suitable habitat exists in the watershed to support steelhead spawning and rearing, but that upstream adult migration is completely prevented by the presence of several barriers in the lower portion of the watershed. The authors concluded that making these barriers passable was essential to steelhead restoration in Alameda Creek and made recommendations to address migration and other steelhead restoration issues in the watershed.

Steelhead Flow Studies MOU

Key ACFRW participants, including the SFPUC, developed and signed an MOU in April 2006 to formalize ACFRW member participation and describe the commitment and process to jointly fund and conduct flow studies to estimate the range, magnitude, timing, duration, frequency, and location of flows necessary to restore steelhead within the creek, while also considering other native fishes and riparian communities in the Alameda Creek watershed and minimizing the potential impacts to agencies responsible for supplying drinking water to customers in Bay Area communities. In December 2006, a consultant was selected to manage the flow studies.

The flow studies are intended to result in a flow strategy that will meet with approval from the CDFG and National Marine Fisheries Service (NMFS) and satisfy regulatory requirements. This strategy, when combined with other aspects of a fisheries restoration program, is intended to provide long-term assurances and certainties for restoring and maintaining native fishes, as well as provide water agencies and other utilities and special districts with long-term assurances and certainties for continued water supply and other infrastructure operations in the watershed. The flow studies are being conducted in three phases, as follows.

Phase 1 includes a review of relevant existing information on hydrologic and geomorphic conditions and fish habitat in the watershed. Based on this foundation, the ACFRW agreed on a detailed study plan for the tasks needed to address uncertainties, including the need to estimate the range, magnitude, timing, duration, frequency, and location of flows necessary to restore a population of steelhead to the creek (while also considering the effects of the flows on other native fishes and riparian communities). That study plan, completed in January 2008 (McBain and Trush 2008), will be implemented in the second phase of the studies. Ten elements addressing key uncertainties included in the study plan are (McBain and Trush 2008):

- Study Plan Element #1: Quantification of Steelhead Habitat
- Study Plan Element #2: Adult Steelhead Passage Assessment
- Study Plan Element #3: Barrier Removal, Retrofit Design, and Remediation
- Study Plan Element #4: Evaluation of Rubber Dam Backwater Pools
- Study Plan Element #5: Water Temperature Monitoring and Modeling

- Study Plan Element #6: Stream Turbidity Monitoring and Assessment
- Study Plan Element #7: Lower Alameda Creek Flood Channel Recovery
- Study Plan Element #8: Water Operations Model and Data Management
- Study Plan Element #9: Considering Other Aquatic Species in Restoration
- Study Plan Element #10: Synthesis and Refinement of Recovery Strategies

Phase 2 will focus on developing a common understanding of the existing conditions in the watershed and collecting the additional data necessary to estimate the flows needed to restore steelhead in the Alameda Creek watershed. This assessment will be based on the review of existing hydrologic and geomorphic conditions and the estimated flows needed to support steelhead throughout their lifecycle in the watershed. Results from Phase 2 will form the foundation from which flow proposals that will support steelhead can be developed and analyzed. The ACFRW currently anticipates that Phase 2 studies will be completed within 1–3 years.

The scope and schedule for Phase 3 will be determined following completion of Phases 1 and 2 and is expected to include the development and analyses of specific flow alternatives, including operational, engineering, and natural resource strategies, with the intent of achieving the restoration goals identified in Phase 2.

The SFPUC plans to incorporate these strategies into its ongoing *Alameda Watershed Habitat Conservation Plan* (discussed below), which will provide coverage for SFPUC water system operations within the Alameda Creek watershed under the Federal Endangered Species Act (FESA) (Section 10) for covered species, including steelhead.

The design of the proposed fish passage projects for the Bay Area Rapid Transit (BART) weir and the ACWD inflatable dams, and others when/if proposed, would also be closely coordinated with the ACFRW's flow studies. Passage alternatives range from total removal of barriers to ladder/screen construction projects, and the flows required to provide passage at different times of the year would vary until a specific design is selected for each location. It is also critical for these designs to be considered in the context of existing and future water supply operations by ACWD, SFPUC, and Zone 7 Water Agency.

SFPUC Alameda Watershed Management Plan

The Alameda Creek watershed is one of three major contributors of water to the SFPUC water delivery system. As such, the primary watershed goal of the SFPUC is to maintain and improve source water quality to protect public health and safety. Secondary goals include the maximization of water supply and the preservation and enhancement of ecological resources.

The purpose of the *Alameda Watershed Management Plan* (WMP) (SFPUC 2001) is to provide a policy framework for the SFPUC to make consistent decisions about the activities, practices, and

procedures that are appropriate on SFPUC watershed lands. To aid the SFPUC in its decision-making, the plan provides a comprehensive set of goals, policies, and management actions, which integrate all watershed resources and reflect the unique qualities of the watersheds. The WMP remains the primary comprehensive plan and City and County of San Francisco (CCSF) policy document for land and resource management of the SFPUC Alameda Creek watershed lands, including all SFPUC lands within the study area.

WMP policies established for aquatic resources include the protection and enhancement of aquatic resources and habitat (AR1 – AR4), water quality (AR5), fisheries resources (AR6), impact assessment for future projects (AR7), management and coordination (AR8 – AR10), and mitigation banking (AR11). WMP actions and guidelines are included for aquatic zone protection and fishery resources. Aquatic zone protection actions and guidelines are included for assessment prior to new activities (aqu1), reservoir and reservoir shorelines (aqu2 – aqu5), stream channels and banks (aqu6 – aqu8), wetlands (aqu9), and sediment basin management and monitoring (aqu10 – aqu13). Fishery resources actions and guidelines are included for fish migration (fis1 – fis4), habitat management (fis5 – fis7), and future studies and monitoring (fis8).

SFPUC Alameda Watershed Habitat Conservation Plan

As part of WMP implementation, the SFPUC, working with U.S. Fish and Wildlife Service (USFWS) and NMFS, is developing a Habitat Conservation Plan (HCP) for incidental take of listed species that may result from SFPUC operations in the Alameda Creek watershed. Steelhead are a covered species in the HCP. Other fish species included in the HCP are Pacific lamprey (*Lampetra tridentata*) and chinook salmon (*Oncorhynchus tshawytscha*). The HCP is being developed in compliance with Section 10 of FESA. In 1983, Congress adopted Section 10 of FESA as a way to promote “creative partnerships between the public and private sectors and among governmental agencies in the interest of species and habitat conservation.” Section 10 authorizes states, local governments, and private landowners to apply for an Incidental Take Permit for otherwise lawful activities that may harm listed species or their habitats. To obtain a permit, an applicant must submit a HCP outlining what will be done to “minimize and mitigate” the impact of the permitted take on the listed species. The principle underlying the Section 10 exemption from FESA is that some individuals of a species or portions of their habitat may be expendable over the short term, as long as enough protection is provided to ensure the long-term recovery of the species. The HCP will require preparation of a joint environmental impact report/environmental impact statement (EIR/EIS) before the SFPUC can consider adoption and begin implementation. USFWS and NMFS will serve as co-lead agencies under the National Environmental Policy Act (NEPA) and the San Francisco Planning Department will serve as the California Environmental Quality Act (CEQA) lead agency for the EIR/EIS. The HCP will provide measures for avoidance, minimization, and mitigation of impacts on steelhead and other covered species that could be affected by SFPUC operations in the watershed.

SFPUC Water Enterprise Environmental Stewardship Policy

On June 27, 2006 the SFPUC established a mission and policy for long-term management of SFPUC-owned lands and their natural resources, including the Alameda Creek watershed, as a fundamental component of the Water Enterprise mission. The policy states that “the SFPUC is committed to responsible natural resources management that maintains the integrity of the natural resources, restores habitats for native species, and enhances ecosystem function. It is the policy of the SFPUC to operate the SFPUC water system in a manner that protects and restores native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands. Releases from SFPUC reservoirs will (consistent with the SFPUC mission..., existing agreements, and applicable state and federal laws), mimic the variation of the seasonal hydrology (e.g., magnitude, timing, duration, and frequency) of their corresponding watersheds in order to sustain the aquatic and riparian ecosystems upon which these native fish and wildlife species depend.” The policy commits the SFPUC to monitoring of habitats, collaboration with interested and affected parties, and various strategies for implementation of the policy (e.g., updating the *Alameda Watershed Management Plan*, developing the HCP for the watershed, developing and implementing the Watershed and Environmental Improvement Program for the watershed, participating in local forums including the ACFRW). The policy commits the SFPUC to “ensure that the policy guides development of project descriptions, alternatives and mitigation for all SFPUC projects during the environmental review process under the California Environmental Quality Act (CEQA) and/or NEPA.”

SFPUC Watershed and Environmental Improvement Program

In 2005, the SFPUC initiated the Watershed and Environmental Improvement Program (WEIP). The WEIP will provide \$50 million over 10 years for the SFPUC to proactively manage, protect, and restore environmental resources affected by SFPUC operations. Funding for the program will include \$20 million from WSIP Measure A bond funds and approximately \$3 million annually from operating funds. The goal of the WEIP is to “protect and restore lands and natural resources critical to the operation of the SFPUC water system.” Objectives of the WEIP are to manage watershed activities and resources to protect source water quality, native species, and their habitat and identify critical watershed lands, key ecosystem restoration needs, and restoration priorities; enhance public awareness of watershed resources, their protection, and restoration efforts; maintain up-to-date watershed assessment and management plans; include key stakeholders in the WEIP; and develop monitoring and feedback mechanisms to measure progress against performance measures.

Aquatic Habitats

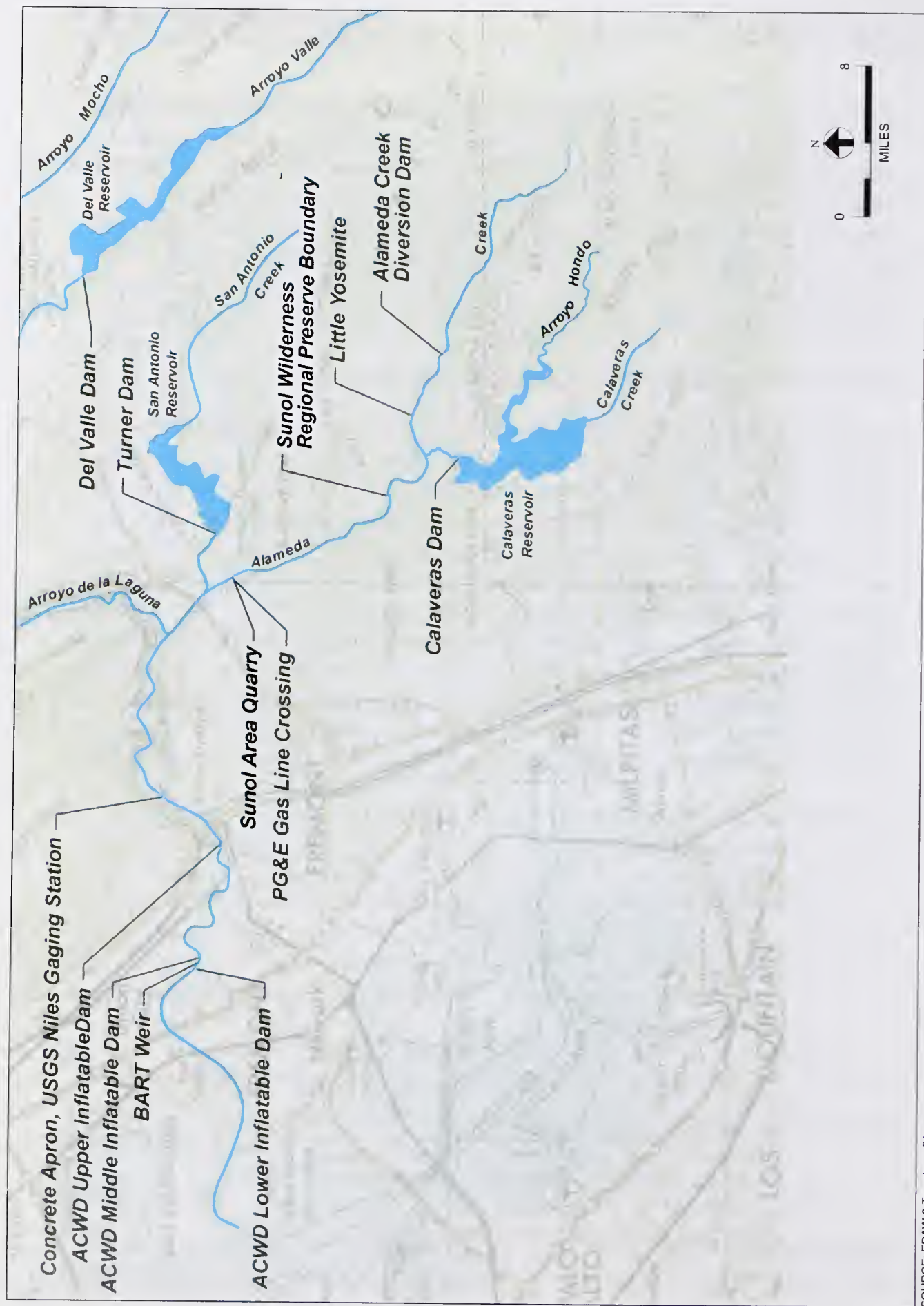
Alameda Creek watershed is an interior Coast Range drainage that originates on the northwestern slopes of the Diablo Range and drains towards San Francisco Bay. The two main branches of the

watershed, Arroyo de la Laguna and Alameda Creek, join at the western end of the Sunol Valley. Alameda Creek is divided into three distinct reaches: lower Alameda Creek, Niles Canyon, and upper Alameda Creek. As discussed above, the lower Alameda Creek and Niles Canyon reaches are located in the extended study area and the upper Alameda Creek reach is located in the primary study area. Fisheries and aquatic habitat characteristics in these reaches are discussed below. Additional information, including a description of specific fisheries and aquatic habitat characteristics, is provided for separate study reaches within the upper Alameda Creek reach primary study area. (See Figure 4.5.1 for a delineation of the primary study area sub-reaches.)

Past and Present Projects Affecting Aquatic Habitat Conditions

A number of existing facilities under the jurisdiction of the SFPUC, ACWD, ACFCWCD, California Department of Water Resources, and Zone 7 Water Agency, among others, strongly affect hydrological and fisheries habitat conditions in the Alameda Creek watershed adjacent to and downstream of the proposed CDRP. Many of these structures and facilities have been in existence for more than 70 years and have resulted in very substantial changes to the mostly natural and unimpaired flow conditions that existed pre-20th Century. Although built in the past, existing structures and facilities continue to operate and affect habitat conditions in the Alameda Creek watershed and thus are part of the existing condition. Some structures are direct barriers to fish migration, while other facilities pose various degrees of control/influence over habitat conditions (Gunther et al. 2000). The major structures and facilities (separated by watershed and/or reach) are depicted in Figure 4.5.2: Major Facilities and Fish Passage Barriers/Obstacles in the Alameda Creek Watershed, and include the following:

- Upper Alameda Creek (primary study area):
 - Calaveras Dam and Reservoir;
 - ACDD and tunnel;
 - Sunol aggregate mining operations and quarries;
 - Sunol stream relocation and channelization;
 - Turner Dam and San Antonio Reservoir;
 - Sunol infiltration galleries; and
 - Pacific Gas and Electric Company (PG&E) gas pipeline crossing protection covering (drop structure).
- Arroyo de la Laguna Watershed (influences extended study area):
 - Del Valle Dam and Reservoir/South Bay Aqueduct, including State Water Project releases;
 - Quarry lakes recharge facilities;
 - Various channelized and culverted stream segments; and
 - Expanding urban development of the Tri-Valley Area.
- Niles Canyon (extended study area):
 - USGS Niles gaging station (11179000) weir/apron.



SOURCE: ED&W & Turnstone JV

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.5.2: MAJOR FACILITIES AND FISH PASSAGE BARRIERS/ OBSTACLES IN THE ALAMEDA CREEK WATERSHED

- Lower Alameda Creek (extended study area):
 - ACWD’s upper, middle, and lower inflatable dams and quarry pit recharge facilities;
 - BART weir; and
 - ACFCWCD channelization project.

All of these structures and facilities, combined with urbanization and other land use activities, have resulted in substantial alteration of habitat conditions in the watershed. It is worth noting that two historic structures—the Niles and Sunol Dams, both located on Alameda Creek downstream of the Sunol quarries—were removed in 2006 by the SFPUC, which improved fish movement conditions and increased the fish habitat. The East Bay Regional Park District (EBRPD) also removed two small barriers from Sunol Wilderness Regional Preserve (Sunol Wilderness) in recent years.

The Calaveras Dam has been in place and operational for more than 70 years. Historic operations, before the DSOD restrictions that were imposed in 2001 and implemented in 2002, included operation of the reservoir with full storage capacity, consistent diversions of upper Alameda Creek flows at the ACDD, annual short-term flushing (sluicing) flows for sediment transport at the ACDD, periodic spills when the reservoir was over capacity, water evacuations through the cone valve at Calaveras Dam, and no flow releases or bypasses for the purpose of maintaining fish habitat downstream. DSOD-restricted operations were initiated in 2001 and occurred from Water Year 2002 to present, thus spanning a period of approximately 8 water years (to date). DSOD-restricted operations include reduced storage in Calaveras Reservoir, water evacuations through the cone valve, no spills, reduced and inconsistent diversions from the ACDD, sluicing of sediments at the ACDD in all but one year (2002) and no controlled flow releases or bypasses for the purpose of maintaining fish habitat downstream.

Primary Study Area

Aquatic habitats in the primary study area include upper Alameda Creek, Calaveras Creek, Arroyo Hondo, and Calaveras Reservoir. The local fish community inhabiting these aquatic habitats is influenced by variations in habitat conditions, species- and life-stage-specific requirements, and daily and seasonal movements and behavior. Several key factors determine suitability of aquatic habitat for various fish species and can be potentially limiting factors to fish populations. These include the frequency and quality of summer pool habitat, substrate conditions, bank and riparian canopy conditions, water temperature, cover, food base, and barriers to fish movement. These factors interact with each other to various degrees and are heavily influenced by streamflow.

This subsection describes conditions in the primary study area. It provides a summary of the available information on aquatic habitats, including habitat assessments, streamflows, and water temperature conditions. Also, see Figure 4.6.5 in Section 4.6, Hydrology, which shows the

elevation profile along Alameda Creek, from the headwaters to the Arroyo de la Laguna confluence.

Information on fish species presence and absence by reach is presented below. Additional information on streamflows and current and historical operation of facilities can be found in Section 4.6, Hydrology; additional information on stream and reservoir water quality characteristics can be found in Section 4.7, Water Quality.

Stream Study Reaches

Alameda Creek, Calaveras Creek, and Arroyo Hondo (primary study area streams) are subdivided herein into study reaches based on differences in hydrology, geomorphology, gradient, land use, water resource development projects, and other features. Each study reach is described below (see Figure 4.5.1).

Reach A-1 (Alameda Creek): From the outlet of Sunol Valley (approximately at the Arroyo de la Laguna confluence near the SFPUC Water Temple) upstream for about 3.5 miles, Alameda Creek flows through a wide, low-gradient (approximately 0.5 to 1.0 percent) alluvial valley. Flow in this reach is intermittent. The stream channel is relatively wide and shallow and is occasionally braided in places. The lower part of Sunol Valley has been heavily influenced by gravel mining activities, including relocation of the channel in some locations, pumping of seepage water to dewater quarry areas, and a system of infiltration galleries used for golf course irrigation water supply. The galleries are currently used to collect water from the creek by subsurface infiltration and from there it is pumped up to San Antonio Reservoir using the Sunol Pump Station. Riparian vegetation is sparse, consisting primarily of low willow scrub and, in the upper part of the valley, widely dispersed mature sycamore trees. Major land uses in the valley currently include quarry operations and large landscaping nursery operations. The stream channel consists primarily of cobble and gravel substrate and is braided in some locations in the upstream portions of this reach. Sand and silt substrate are present in the lower portions of this reach. Streamflow in this reach both during pre-DSOD restricted conditions and under the baseline conditions becomes intermittent or ceases completely during the dry season and is influenced by operations at both the ACDD (during the wet season) and Calaveras Dam (year-round). Additionally, this reach has been documented to be a “losing reach” (net reduction in surface water flows between two points) due to natural deposits of alluvial sediments into which the surface flow infiltrates, and past channel realignment and pit capture of streamflows in areas where aggregate quarries are present. Measurements in this reach have shown a progressive decrease in streamflow with distance downstream, including losses up to 36 percent at certain locations (ENTRIX 2006, pp. 15-20).

Habitat values in this reach are limited for all native fish species present in the watershed. Habitat in the lower segment of the reach that flows through the gravel mining operations is

especially poor, with little riparian vegetation cover or shade components and a heavily altered (realigned trapezoidal) channel. Fish migration is limited in this segment due to the presence of several critical riffles (shallow, high-velocity water areas) and the PG&E gas pipeline crossing concrete mat structure, which, at 10 feet high over a horizontal span of about 30 feet, is a substantial barrier at all but the highest flows (Gunther et al., 2000, p. 33).

The creek segment upstream of the quarry supports sycamore alluvial woodland habitat, and examination of historical aerial photographs indicates that similar habitat existed in the lower segment prior to mining activities. Fish monitoring conducted by the SFPUC (summarized in ETJV 2008) immediately upstream of this reach (A-2) indicates that habitat conditions favor warm-water species.

Diversions from Alameda Creek to Calaveras Reservoir have generally been reduced since 2002 from those of historic operations because of the DSOD restrictions on Calaveras Reservoir. Total flow in Reach A-1 of Alameda Creek and upstream to the confluence of Calaveras Creek is the product of the combination of releases from Calaveras Dam, flow spilled over the ACDD, releases from Turner Dam into San Antonio Creek (tributary to Alameda Creek), and the unregulated inflow runoff occurring between Reach A-1 (e.g., Welch Creek) and the diversion dam and Calaveras Dam. The reduced flow conditions resulting from the operation of the ACDD and Calaveras Dam over the last 70+ years have strongly influenced sediment transport and the resulting channel forms and substrate conditions that are present today.

Currently, Calaveras Reservoir is often filled near, or for short times above, the maximum DSOD-permitted storage level with runoff from its natural drainage and, at these times, has no capacity to accept diversions from Alameda Creek. Therefore, while the DSOD restrictions on Calaveras Dam are in effect, the SFPUC has had limited ability to capture local watershed runoff from upper Alameda Creek, and post-2002 flows in Alameda Creek downstream of the diversion dam have been at times substantially greater than they were prior to the DSOD restrictions. Based on hydrologic modeling, operational releases from Calaveras Reservoir occur in about 40 percent of the years modeled under the existing baseline condition, with most of these years being classified as above-normal or wet. Those releases combined with the upper Alameda Creek flows over the ACDD form the primary basis of flow in Reach A-1, to which there is the contribution inflow from smaller tributaries like Welch Creek.

Table 4.6.7 provides a summary of monthly data from the Welch Creek gage. Figure 4.6.7: Daily Flow in Alameda Creek Downstream of the Welch Creek Confluence, Water Years 1998-2009, shows daily flow at the gage as well as historic daily reservoir levels. Periods of high flow at the gage correspond with releases at the dam. Other periods of steeply dropping water surface elevation without flow spikes in Alameda Creek indicate diversions for water supply and, to a much lesser degree, evaporation from Calaveras Reservoir.

Water temperature data for Alameda Creek near the town of Sunol are presented in Table 4.7.3, Summary of Temperature Data, Alameda Creek Near Sunol, 1997-2005, in Section 4.7, Water Quality. Temperatures in July–October 1998 ranged from a high of 78.8 degrees Fahrenheit (°F) to a low of 59°F. Water quality in this reach is generally good and protective of beneficial uses. No dissolved oxygen (DO) data are available for this reach.

Reach A-2 (Alameda Creek): From about 0.5 mile downstream of the bridge near the entrance of the SVWTP to the confluence of Calaveras Creek, the valley narrows and the stream becomes more confined, primarily within a single channel bordered by relatively well-developed riparian trees and undergrowth. The gradient is relatively low in this reach (approximately 1-2 percent), but the more confined channel is characterized by relatively long pool and run sequences broken by short riffles. Much of the pool habitat is relatively deep (2.5-foot depth or greater). Streamflow during the summer may become intermittent in dry years but is less variable than that in Reach A-1. SFPUC studies have shown that this reach favors native warm-water fish species and many portions of this reach are influenced by cattle grazing activities along the creek banks and in the channel. In some areas, the stream widens and instream flows become shallow with very little riparian cover, which warms the water over a short distance during the summer. Algal growth in the creek can be extensive during the summer and early fall (survey data and monitoring results summarized in ETJV 2008).

Similar to Reach A-1, streamflow in this reach is influenced by operations at both the ACDD and Calaveras Dam. The upper portion of this reach of Alameda Creek is located immediately downstream of the confluence of Calaveras Creek and Alameda Creek and thus was the area intended to benefit from flows under the 1997 MOU (CDFG 1997, p. 4). Figure 4.6.6: Daily Flow in Alameda Creek Downstream of the Calaveras Creek Confluence, Water Years 1998-2009, shows daily flow at the gage up to 200 cfs (maximum limit of record at the gage). Temperature measurements taken in Reach A-2 between July 16 and October 26, 1998 ranged from a high of 29.3°C during early September to a low of about 10.5°C in October, with daily temperature fluctuations ranging from 6 degrees Celsius (°C) to 10°C (SFPUC 1999,

p. 4-1). In 2004, the average DO concentration for the three monitoring stations in the same stretch of Alameda Creek downstream of the confluence with Calaveras Creek was 5.5 milligrams per liter (mg/L), the average pH was 7.3, the average temperature was 14.7°C, and the average turbidity was 0.89 nephelometric turbidity units (NTU) (SFPUC 2006, p. 5-19).

Reach A-3 (Alameda Creek): Just upstream of the Calaveras Creek confluence, in the area commonly referred to as “Little Yosemite,” the Alameda Creek channel becomes very steep (approximately 15 percent gradient) and well-confined with little or no flood plain. The substrate is dominated by boulders and bedrock. The riparian vegetation is relatively dense and the surrounding canyon walls are steep. The numerous cascades, bedrock chutes, and waterfalls in

this section likely form a natural barrier to upstream migration of several of the native fish species and most of the introduced species. Likely in the historical unimpaired (pre-dam) conditions and as observed under the existing condition, there is some intermittent streamflow in this reach during the dry season. During pre-DSOD restricted operations of Calaveras Reservoir and the ACDD, dry-season flows commonly disappeared in all but wet years, leaving only isolated pools as fish habitat. Habitat in this reach is generally considered good quality for both warm-water and cold-water fish species; however, access is limited by steep gradient and migration barriers, and oversummer rearing habitat for rainbow trout is limited by naturally low flows and warm water temperatures. Winter and spring (and potentially year-round) streamflow in this reach is influenced by operations of the ACDD (e.g., diversion of water from Alameda Creek to Calaveras Reservoir) (see Table 4.5.1 for periods of operation). As described above, diversions from Alameda Creek to Calaveras Reservoir at the ACDD have been substantially reduced since 2002 because of the DSOD restrictions on Calaveras Reservoir.

Table 4.5.1: Operations of the ACDD During DSOD Restrictions (2001 to Present)

Opened	Closed
November 13, 2002	December 18, 2002
February 13, 2003	May 2, 2003
September 29, 2003	October 24, 2004
March 13, 2007	February 5, 2008
November 3, 2008	February 27, 2009

Source: SFPUC unpublished data

Temperature measurements in Reach A-3 between July 16 and October 26, 1998 ranged from a high of 24.3°C in mid-July and early August to a low of 12°C in October, with daily temperature fluctuations ranging from 2°C to 6°C (SFPUC 1999, p. 4-1). In 2004, the average DO concentration for the three monitoring stations in Alameda Creek downstream of the ACDD was 7.9 mg/L, the average pH was 7.7, the average temperature was 15.7°C, and the average turbidity was 0.83 NTU (SFPUC 2006, p. 5-19).

Reach A-4 (Alameda Creek): Upstream of Little Yosemite to the ACDD, the stream gradient generally decreases (approximately 2-4 percent); however, there are a few relatively steep sections (>10 percent). The channel is less confined and riparian vegetation ranges from sparse stands of mature sycamore to more dense areas with willow, alder, sycamore, and oak. Portions of the channel go dry during the summer season. Approximately 36 percent of the reach was dry during late summer 2005, an above-normal water year (ETJV 2008). The ACDD forms the upper boundary of Reach A-4 and appears to be a complete barrier to all fish migration.

Habitat values in this reach vary seasonally with streamflows. Habitat is somewhat fragmented by sections of stream with alternating alluvial sections that go dry in summer and by steep bedrock canyon gradient sections that present upstream migration passage obstacles, and possibly

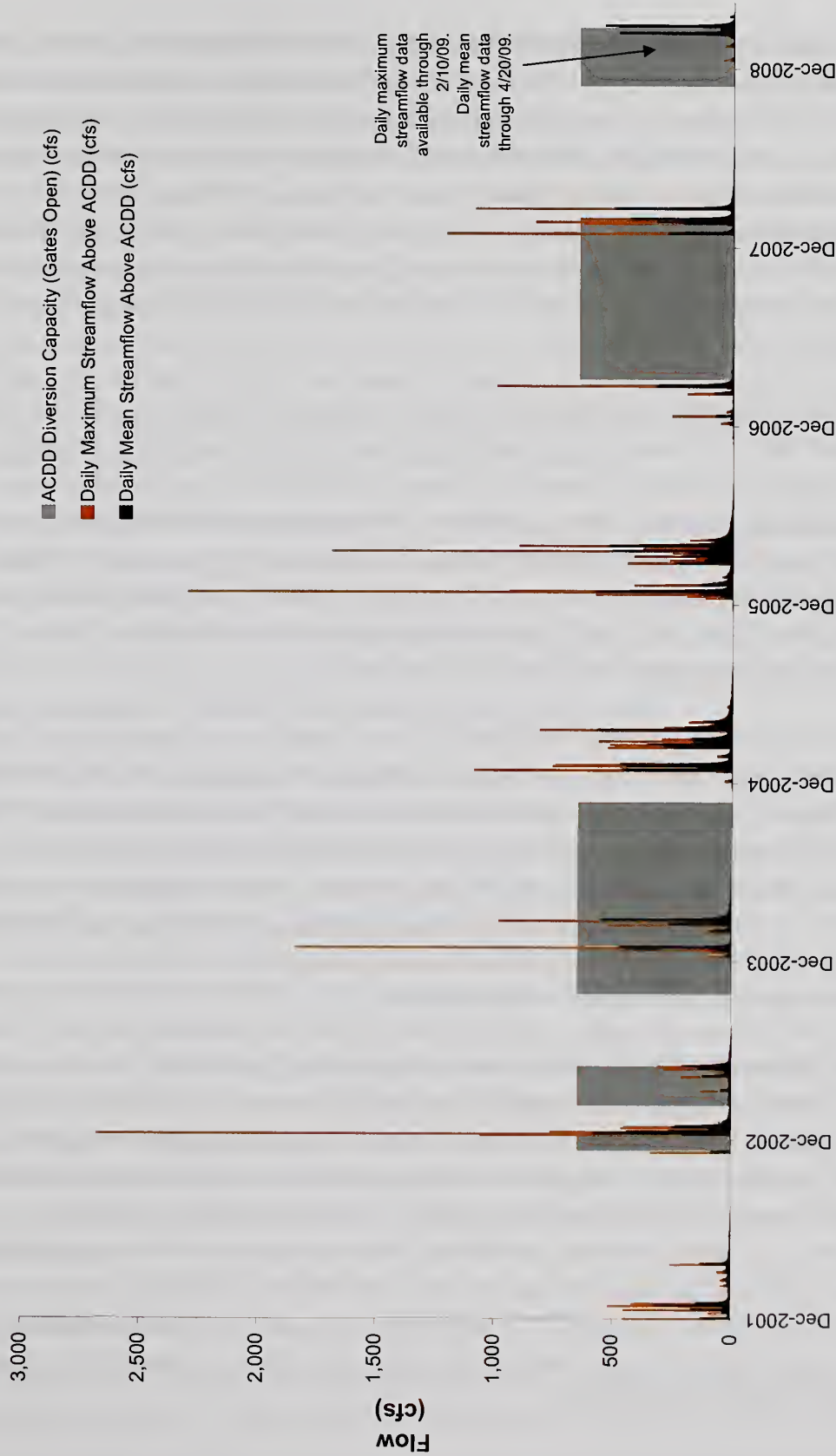
barriers, for fish. Habitat values generally range from marginal to good for both warm- and cold-water species. Operation of the ACDD (i.e., diversion of water to Calaveras Reservoir) can greatly influence aquatic habitat conditions downstream as all flows up to 650 cfs can be diverted when the gates are open in the winter and spring. ACDD diversions can result in low- or no-flow conditions downstream at times when flow would otherwise be present, and such conditions were typical prior to implementation of the DSOD restrictions in 2002 (see Tables 4.5.1 and 4.6.13 and Figure 4.6.10: Average Daily Unimpaired Inflow, Diversions, and Calculated Spill at ACDD, Water Years 1998-2009). Since DSOD restrictions were put in place, reduced diversions have resulted in more flow in this reach being passed over the ACDD during the rainy season (see Figure 4.5.3: Daily Flows in Alameda Creek and Diversions at the ACDD during DSOD Restricted Conditions).

As shown by Table 4.6.13, unimpaired flows upstream of the ACDD in Alameda Creek are seasonally highly variable, with minimal flows during the summer months. Flow through this reach of Alameda Creek downstream of the ACDD has been altered during high-flow periods in the winter and spring under historical dam operations as compared to flow rates under current DSOD-restricted operations. Flows in summer and early fall, which on average dwindle to less than 2 cfs from July through October (see Table 4.6.5), were generally bypassed under both pre-DSOD and current DSOD-restricted operations. Bypass flows pass over or through (base flow) the ACDD into this reach of Alameda Creek.

Reach A-5 (Alameda Creek): From the ACDD to Camp Ohlone the stream characteristics are similar to Reach A-4 for several miles, varying mostly in the degree to which the channel remains wetted during the dry season. Approximately 10 percent of the reach was dry during the late summer 2005, an above-normal water year (ETJV 2008). Habitat features include step-runs, pocket water, cascades, and bedrock chutes that are typically associated with higher gradient streams. Water temperatures are generally cooler in this reach compared to areas downstream. Camp Ohlone is considered the upper boundary of this reach. Streamflows are natural and unrestricted. The proposed project operations would not influence streamflows in this reach.

Reach A-6 (Alameda Creek – Upstream of Camp Ohlone): This reach has both low-gradient, alluvial sections that are dry or intermittent in summer and steeper gradient sections dominated by bedrock and boulders with year-round flow. The higher gradient sections include features typically associated with good trout habitat, including large bed elements, low amounts of fine sediments, and a high proportion of relatively deep pools. Although summer streamflow is quite low and water temperature is warm, this reach of Alameda Creek provides suitable spawning and rearing conditions for resident trout. At three locations, steep boulder falls present fish passage obstacles under low-flow conditions. One of these may be impassable at all but extreme high flows. Streamflow is natural and unimpaired.

Diversion During DSOD Restriction Alameda Creek Diversion Dam



Notes:

- Areas shown in grey are periods when the gates were open to the tunnel from ACDD to Calaveras Reservoir and streamflow was diverted. Periods not shown in grey indicate the gates to the tunnel were closed and streamflow was not diverted. When the gates are open, the diversion capacity is 650 cfs, while larger flows pass over the diversion.
- This graphic is only representative of the period of ACDD operation when the storage level in Calaveras Reservoir was restricted by DSOD (restriction imposed in 2001).

SOURCE: USGS gage 11172945; ACDD operations data provided by SFPUC in 2009, compiled by ETJ/V in 2009.

CALAVERAS DAM REPLACEMENT PROJECT

**FIGURE 4.5.3: DAILY FLOWS IN ALAMEDA CREEK AND DIVERSIONS
AT THE ACDD DURING DSOD RESTRICTED CONDITIONS**

Reach C-1 (Calaveras Creek – Downstream of Calaveras Reservoir): Reach C-1 is a very short reach (approximately 0.6 mile) extending from the confluence with Alameda Creek upstream to Calaveras Dam. The reach consists of deep pools, glides, and short low-gradient riffles formed by steep rocky gorge-type topography with bedrock and large boulders. Stream hydrology is highly altered by the operations of Calaveras Dam, experiencing very low base flows (approximately 0.5 to 1.0 cfs) except during periods when, to meet DSOD requirements, reservoir releases are made through the cone valve. (Recent releases varied from approximately 335 to 375 cfs; operational range is between 130 and approximately 1,000 cfs depending on reservoir level.)

A USGS gage was installed in Calaveras Creek below Calaveras Reservoir, with data available from October 2002 to the present. Flow rates in this reach of the creek are assumed to have generally increased in volume and duration in comparison with similar past hydrologic years under the pre-DSOD restricted operating condition, due to increased releases required at present to maintain the lowered reservoir water level. However, data quantifying the degree of this increase are partially available due to the brief gage record. Table 4.6.4 presents the monthly statistics for Water Years 2003-2009. Table 4.6.4 clearly shows periods of release from Calaveras Dam followed by periods of very little base flow.

Stream water temperature is directly influenced by reservoir release water temperatures from the relatively cool hypolimnion¹ (<26°C) and seepage flow downstream of the dam. Physical habitat values for fish are limited by variations in stream hydrology resulting from dam releases. Habitat values are considered marginal for both warm- and cold-water fish species. While Reach C-1 receives flow releases from Calaveras Dam, this reach was not directly considered a target habitat to benefit from flows that are part of the 1997 MOU, as the point of compliance is downstream at the confluence with Alameda Creek. Information about water quality in Calaveras Creek is provided in Table 4.7.5, in Section 4.7, Water Quality.

Reach C-2 (Calaveras Creek – Upstream of Calaveras Reservoir): Calaveras Creek upstream of Calaveras Reservoir currently lacks hydrological connection with the reservoir at the lowermost segment of the creek due to the lack of a defined channel and riparian vegetation that has resulted from the lowered reservoir level. Upstream from this segment, the creek exhibits a more defined channel form with a moderate gradient, confined stream with varying flow, primarily gravel and cobble substrate, and relatively dense although somewhat degraded riparian vegetation. Portions of the stream channel have been armored and channelized, and the channel has become incised about 8 feet deep. This reach provides potential cold-water habitat, but both the extent of accessible habitat is limited and the quality of the habitat is marginal due primarily to naturally low summer streamflows.

¹ The hypolimnion is the dense, bottom layer of water in a thermally stratified reservoir. It is the layer that lies below the thermocline (temperature mixing zone).

Reach AH-1 (Arroyo Hondo): For about 1.8 miles upstream of the upper storage elevation of Calaveras Reservoir, Arroyo Hondo is a moderate gradient, confined stream with perennial flow, primarily gravel and cobble substrate, and relatively dense riparian vegetation. Below the upper storage elevation (756-foot elevation) down to the DSOD-required elevation, Arroyo Hondo exhibits conditions that are a result of previous inundation. These conditions include shallow riffles and glides with sparse riparian vegetation cover on the adjacent flood plain and bars. At the lower portion and below this zone, ongoing reservoir operations influence the formation of sediment wedges at the confluence with the reservoir. These sediment wedges can create fish migration barriers and impediments through formation of shallow riffles, subsurface flows, and/or elevated sediment loads during active sediment wedge mobilization. Blockage or impediment of movement of resident fish in the reservoir influences their access to upstream habitat that is required for various fish life stages (e.g., rainbow trout spawning).

At the upstream end of this reach, a massive landslide has deposited large boulders in the creek, forming a series of steep cascades and falls that are a barrier to upstream fish migration (ETJV 2008, URS and HDR 2009). There is good quality cold-water fish habitat in Arroyo Hondo and its tributaries in the segment of creek between the reservoir level drawdown zone² and the landslide. The sediment load deposited by the upstream landslide appears to have reduced the quality and quantity of suitable trout spawning habitat in this reach.

Table 4.6.3 provides a summary of monthly data from the Arroyo Hondo gage. Figure 4.6.3a: Daily Flow in Arroyo Hondo Upstream of Calaveras Reservoir, Water Years 1998-2009 and Figure 4.6.3b: Daily Flow in Arroyo Hondo Upstream of Calaveras Reservoir, Winter Months of Water Year 2006, shows daily flows at the gage. Periods of high and low flows at the gage correspond with seasonal precipitation patterns in the watershed.

Reach AH-2 (Arroyo Hondo): There are many miles of Arroyo Hondo and its tributaries in a relatively undisturbed landscape upstream of the landslide. While this reach of Arroyo Hondo would not be influenced by the proposed project and is therefore not included in the study area, a brief discussion is included to provide background information on upstream conditions. In the lower 2 miles of this reach, habitat conditions are suitable for trout, although summer water temperatures are relatively high and streamflows can be very low in some sections. Riparian canopy is relatively thin and this condition likely contributes to the warm summer water temperatures.

Calaveras Reservoir

Varying reservoir storage levels, which are determined by operation of the reservoir and seasonal precipitation and runoff conditions, affect water temperatures and DO levels in the reservoir.

² Segment of creek within the reservoir drawdown zone is generally exposed and lacking riparian vegetation due to prior inundation by the reservoir.

Typically, water storage levels increase between November and March and decrease between April and October (ETJV 2008, SFPUC 2006). The following discussion of aquatic habitat conditions in Calaveras Reservoir is summarized from the *Calaveras Dam Replacement Project Fisheries Technical Report 2008* (ETJV 2008, pp. 27-30). Calaveras Reservoir operations and water quality are discussed in Section 4.6, Hydrology, and Section 4.7, Water Quality.

The reservoir provides both warm-water and cold-water fisheries habitat. The surface water warms during the summer months, while water at greater depth stays relatively cold year-round. This thermal stratification results in minimal circulation between the cold bottom waters and the warm surface waters during the summer months. When the reservoir is stratified, the temperature of the epilimnion (upper part of the water column) typically ranges between 15°C and 25°C while the hypolimnion (lower part of the water column) ranges between 8°C and 12°C. During stratification, there is a relatively thin transitional area (thermocline) between the epilimnion and hypolimnion that generally begins 20–40 feet below the water surface. The maximum temperature difference between epilimnion and hypolimnion generally occurs in late summer.

The density difference between the warm epilimnion and cold hypolimnion during summer and fall months prevents mixing and circulation of water between the two layers. Historically during the stratified period, DO was depleted in the lower, cold layer by biological processes of decomposition and decay and was not readily replenished by diffusion of oxygen from the atmosphere or by photosynthesis of algae and aquatic plants that primarily occur at or near the water surface. In the hypolimnion, DO levels dropped below 5 mg/L for much of the summer and oxygen was completely depleted in the deepest waters. During this period, the narrow transition zone (thermocline) was the only part of the reservoir where conditions were suitable for cold-water species such as trout that require both cold temperature and relatively high levels of DO. In more recent times, this condition has been improved through the use of a hypolimnetic oxygenation system (HOS), which delivers DO into the hypolimnion and was installed in September 2005 (see Section 4.7, Water Quality, for more information about the HOS).

In the fall, thermal stratification breaks down as the epilimnion begins to cool and mixes to a greater depth. The water temperature profile is generally isothermal (same temperature throughout the water column) from November to March at between 7.5°C and 11°C. With little or no difference in temperature from surface to bottom, circulation results in re-oxygenation (through atmospheric diffusion) of the entire water column. Nutrients released from biological decay in the hypolimnion and sediments are also circulated through the water column during de-stratification periods.

The reservoir is relatively productive and algal blooms can occur during the warmer months, particularly June through October. Algal blooms can result in diurnal photosynthesis-induced increases in surface DO levels and swings in pH. Algal growth is often reduced by zooplankton

as they graze on the algae; however, zooplankton may not be completely effective in controlling blue-green algae. Up to 2005, the growth of blue-green algae was occasionally managed by applying copper sulfate; copper sulfate has not been applied since. Copper sulfate treatments in Calaveras Reservoir are also discussed in Subsection 3.3.4.6, On-Site Water Treatment, in Chapter 3, Project Description, and in Subsection 4.7.1.1, Existing Conditions, in Section 4.7, Water Quality.

Current baseline reservoir operations influence aquatic habitat conditions, both within and upstream and downstream of the reservoir, in four major ways. First, the volume of the hypolimnion is reduced under lower storage conditions. The thickness of the epilimnion is relatively constant, so lower storage levels in the spring will result in a smaller cold-water pool in the fall. Historical monitoring data indicate that DO concentrations may be maintained at higher levels and for greater duration in a larger portion of the reservoir when the volume of the hypolimnion is larger (summarized in ETJV 2008).

Second, storage levels, particularly during the late winter, influence the frequency of spills (or releases) to Calaveras Creek. If the reservoir is at or near capacity (under current DSOD-restricted conditions or under pre-DSOD unrestricted conditions) and late-season runoff is high, a spill or release event is more likely. Spills or releases from Calaveras Reservoir can provide a range of flows depending on the magnitude and duration of upstream inflows and potential water deliveries made to the SVWTP. These flows affect downstream aquatic habitats through changes in wetted area, water depths, water velocities, and geomorphic processes (e.g., erosion, sediment transport and deposition).

Third, storage levels influence fish migration passage into and out of reservoir tributaries, including Arroyo Hondo and Calaveras Creek. Under full storage conditions (pre-DSOD restrictions), fish habitat connectivity conditions between Calaveras Reservoir and Arroyo Hondo were superior to current conditions under the DSOD restrictions. At lower storage levels, such as under DSOD storage limitations, there is a section of Arroyo Hondo that flows through the reservoir drawdown zone and associated exposed sediment wedge (see above). This section of the creek has no riparian vegetation and fish passage conditions have deteriorated due to lack of cover from predation, increased water temperature, and difficult passage at shallow riffles associated with the exposed sediment wedge.

Fourth, storage levels influence the temperature and quality of releases to Calaveras Creek. As discussed above, increased storage levels generally increase the amount of cold water and improve the quality of the water available for release to Calaveras Creek and from there into Alameda Creek.

Under the 1997 MOU between CDFG and the SFPUC, the SFPUC committed to supplement flows in upper Alameda Creek, when natural flows downstream of the confluence of Alameda

and Calaveras Creeks are less than the defined minimums, by releasing water from Calaveras Reservoir. The releases are intended to enhance cold-water habitat in Alameda Creek downstream of the Calaveras Creek confluence, while also benefiting the existing resident warm-water fishery (CDFG 1997, p. 4). Releases would be made from one of three intake adits located at Elevations 664, 699, and 727 feet. The ends of the upper two adits have fish screens to prevent entrainment of fish (SFPUC 1991, p. 2). The deepest intake does not have a fish screen, as juveniles generally do not occupy the deep water habitat. The best quality water for release to the creek is from the hypolimnion (i.e., the layer below the thermocline). Storage levels influence the vertical and horizontal location of the thermocline relative to the intake adits. Historical data indicate that water of suitable quality (DO and temperature) for downstream releases is generally available when Calaveras Reservoir storage is at least 30,000 acre-feet (AF) (ETJV 2008, p. 29). As discussed above, release of stored water from Calaveras Reservoir under the MOU has not yet been initiated due to lack of facilities for recapturing released water. Recapture facilities are discussed in Section 6.2, Cumulative Impacts, and in the WSIP Final Program EIR.

Extended Study Area

Lower Alameda Creek

Beginning downstream from the mouth of Niles Canyon, Alameda Creek flows approximately 10 miles across a broad low-gradient alluvial plain to San Francisco Bay. Historically, before extensive urbanization of the flood plain, the stream channel was relatively unconfined and would migrate and form different courses and distributary channels (Leidy 2007, appendices). These channels were tidally influenced in their lowest sections and likely provided valuable estuarine habitat function for many fish species, including rearing steelhead juveniles and smolts during their transition to the higher salinity of bay water (Gunther et al. 2000, p. 22).

The lower Alameda Creek channel was extensively modified beginning in the 1950s as a result of urbanization, instream aggregate extraction, and the construction of flood control and water conveyance facilities. In 1972, the lower reaches of Alameda Creek (e.g., downstream of Niles Canyon) were rerouted into a trapezoidal flood control channel confined between artificial levees. To maintain flood control capacity, sediment and vegetation must be removed from the channel periodically. The historic flood plain has been largely converted to residential, commercial, and industrial urban uses including industrial salt production in an extensive system of evaporation ponds that removed historic wetlands and natural tidal channels. Substantial ecological restoration has been conducted at Coyote Hills Regional Park on the south side of the Alameda Creek levee at the San Francisco Bay. Some of the salt ponds to the north of the Alameda Creek north levee are planned to be restored to those former conditions under the South Bay Salt Ponds Restoration Project. Water supply and flood control structures have been incorporated into the channel; these structures include a grade control structure at the BART rail crossing (the BART weir) and a series of inflatable dams for water supply impoundment (including flows imported

from the Sacramento-San Joaquin Delta via the South Bay Aqueduct), local aquifer recharge, and diversion. Many of these features impede fish migration and impair other fish habitat functions. The BART weir (an 8-foot sloping concrete grade control structure constructed to protect the BART tracks from erosion) presents a complete barrier to all migrating anadromous fish species with the possible exception of Pacific lamprey (Gunther et al. 2000, p. 15). The lower, middle, and upper ACWD inflatable dams are also major migration obstacles/barriers in lower Alameda Creek, the middle inflatable dam being generally operated to create an 11-foot-high obstacle located immediately adjacent to the BART weir. A more detailed discussion of migration barriers in the Alameda Creek watershed is provided below.

Aquatic habitat conditions in the flood control reach of lower Alameda Creek are characterized by low summer flows, high summer water temperature, substrate with a large silt component, extensive stands of emergent vegetation, and tidal mixing with increased salinity in the lower sections near the San Francisco Bay and freshwater flows in the higher lying reaches upstream of the BART weir. Some sections may be dry during the summer (Hanson Environmental Inc. 2002).

Niles Canyon

Beginning downstream of the Arroyo de la Laguna confluence, Alameda Creek flows approximately 6.5 miles through Niles Canyon to Niles Junction (near the crossing of Highway 238). The stream channel is relatively confined within the steep walled canyon and, with the exception of Highway 84 and a rail line, there is little development on the narrow flood plain and surrounding hills. There is a relatively well-developed riparian zone throughout Niles Canyon. There are two major tributaries in this reach, Sinbad Creek and Stonybrook Creek. The reach is a relatively low-gradient (approximately 1-2 percent) perennial stream characterized by large, moderately deep pools, and runs separated by short, shallow riffles. The substrate is highly variable, ranging from sand, gravel, and cobble-dominated riffles and glides to cobble-boulder and silt, mud, and sand pools.

Prior to the development of water resource projects throughout the watershed, Alameda Creek in Niles Canyon was likely an intermittent to perennial stream characterized by low flows during late summer and fall. Dry-season flows were derived from subsurface flows from the Sunol and Livermore Valleys and tributary inflow and may have been relatively cool. Low dry-season flows were derived primarily from upstream subsurface flows (shallow groundwater that enters the canyon below Sunol) that may have been relatively cool due to their source as groundwater and the limited exposure to warm atmospheric conditions in the shady canyon. During this low-flow condition, some pools may have thermally stratified and provided thermal refuge (cool water layer on the bottom of pools) during summer months (McBain and Trush 2008, p. 10).

Alameda Creek through Niles Canyon now serves as a conveyance for imported water supply from the South Bay Aqueduct turnout in Vallecitos Creek, which is tributary to Arroyo de la Laguna just upstream of the Alameda Creek confluence. As a result, summer base flows in Niles Canyon have increased and become less variable, thereby increasing overall water (and pool) temperatures, reducing thermal buffering that historically occurred (prior to large water resource projects being implemented) with subsurface flows, reducing potential pool stratification, and subsequently reducing potential rearing habitat for rainbow trout. However, although the stream temperatures within the reach are probably higher than those of pre-development flows, augmented flows potentially provide atypical fast-water habitat that may allow trout to obtain sufficient food to withstand warmer temperatures (Gunther et al. 2000, p. 18).

Flow in lower Alameda Creek is measured by two USGS gages near the downstream end of Niles Canyon and within the flood control channel, near the Interstate 880 overcrossing. These gages record flows from Sunol Valley (Alameda Creek) and Livermore Valley (Arroyo de la Laguna, Arroyo Mocho, and Arroyo Del Valle), as well as releases made into the creek from the State Water Project on Vallecitos Creek and inflow from the Niles Canyon watershed. Recent flow data from the Niles gage are presented in Table 4.6.8 and in Figure 4.6.8: Average Daily Flow in Alameda Creek near the Downstream End of Niles Canyon, Water Years 1998-2009, to illustrate the range and seasonal variation of flows in lower Alameda Creek. The Niles gage has been in operation since 1891; however, the data presented in Table 4.6.8 and in Figure 4.6.8, illustrate flows under more recent operation of water control facilities in the upper watersheds (including Alameda Creek and Arroyo de la Laguna). Similar to flows in the creeks in the upper watersheds, flow at Niles is flashy (subject to short term flow spikes during and after rainstorms), with daily peaks of high flows in winter months and very low flow in summer months. These flow conditions are present with both pre- and post-DSOD restricted operations at Calaveras Dam.

Because of the augmented summer flows, rearing conditions in wet hydrologic years could be improved (over natural conditions) despite higher water temperatures, assuming trout tolerate these higher temperatures. In some instances, with sufficient food present, rainbow trout may tolerate warmer water temperatures than previously thought (Smith 1999). Local anglers continue to catch rainbow trout in the Niles Canyon reach, despite the cessation of trout stocking several years ago (ETJV 2008), suggesting possible successful rearing. However, while rainbow trout from farther upstream could be present in the Niles Canyon reach during wet years, it is likely that the conditions are generally not conducive to oversummering in this reach. Results of water temperature monitoring within the Niles Canyon reach of Alameda Creek during 2001-2002 (Hanson Environmental 2002) showed summer temperatures in excess of 75°F, which would substantially affect the ability of juvenile and adult rainbow trout to oversummer within the canyon reach. Monitoring conducted by Hanson Environmental in 2001 and 2002 also shows that water in Alameda Creek is in thermal equilibrium by the time it flows to the Niles Canyon

reach of the creek, likely due to the prolonged solar warming occurring in Alameda Creek from the Sunol Wilderness to the Niles Canyon reach. Operation of upstream storage facilities including Del Valle, San Antonio, and Calaveras Reservoirs has reduced winter and spring peak flows from pre-development conditions in this reach of Alameda Creek.

It is worth noting that the above-grade portions of two historic structures – the Niles and Sunol Dams, both located on Alameda Creek in the Niles Canyon reach – were removed in 2006 by the SFPUC. Removal of these structures resulted in generally improved movement conditions for fish in this reach.

Fish Species and Aquatic Communities

Alameda Creek, Calaveras Creek, Calaveras Reservoir, Arroyo Hondo, and tributaries provide habitat for a diverse assemblage of native and non-native fishes (see Table 4.5.2). A total of 14 native and at least 13 non-native fish species have been observed in nontidal portions of the Alameda Creek watershed during the past century (Gunther et al. 2000, p. 13; ETJV 2008, pp. 31-33; Leidy 2007, p. 185). Several other species may have also occurred in the watershed based on collections in tidal portions, evidence from archaeological investigations, and other accounts.

Many collections from the watershed include widely distributed species typical of streams in the region, such as California roach (*Lavinia symmetricus*), Sacramento sucker (*Catostomus occidentalis*), pikeminnow (*Ptychocheilus grandis*), steelhead/rainbow trout (*Oncorhynchus mykiss*), Pacific lamprey (*Lampetra tridentata*), and prickly sculpin (*Cottus asper*) (Gunther et al. 2000, p. 13; ETJV 2008, pp. 31-33; Leidy 2007, p. 185).

Non-native resident species present in the watershed include goldfish (*Carassius auratus*), carp (*Cyprinus carpio*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), white catfish (*Ameiurus catus*), brown bullhead (*Ictalurus nebulosus*), black bullhead (*Ameiurus melas*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), western mosquitofish (*Gambusia affinis*), inland silverside (*Menidia beryllina*), and golden shiner (*Notemigonus crysoleucas*) (Gunther et al. 2000, p. 13; ETJV 2008, pp. 31-33; Leidy 2007, p. 185).

Stream Fish Communities

The following discussion of stream fish communities was taken from ETJV 2008 (pp. 31-33) and includes a description of species occurrence, distribution, and relative abundance specific to the primary study area. It is followed by an assessment of primary factors limiting the fish population. A discussion of the benthic macroinvertebrate (BMI) community is also provided.

Table 4.5.2: Fishes Observed in the Alameda Creek Watershed

Common Name	Scientific Name	1905 Synder	1927 Follet	1934 Seale	1938 Shapovalov	1953 Follett	1955 Follett	1957– 1958 Follett	1961 Hopkirk	1972 Follet	1973 CDFG	1977 Scoppettone and Smith	1984 Leidy	1998– 2004 SFPUC	2007 Leidy
Native Species															
Pacific lamprey	<i>Lampetra tridentata</i>						✓	✓			✓			✓	✓
California roach	<i>Lavinia symmetricus</i>	✓		✓				✓	✓			✓	✓	✓	✓
Hitch	<i>Lavinia exilicauda</i>	✓		✓			✓			✓	✓		✓		✓
Sacramento blackfish	<i>Orthodon microlepidotus</i>			✓			✓	✓	✓	✓	✓				✓
Sacramento pikeminnow	<i>Pychocheilus grandis</i>	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓
Speckled dace	<i>Rhinichthys osculus</i>				✓										
Sacramento sucker	<i>Catostomus occidentalis</i>	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓
Steelhead/rainbow trout	<i>Oncorhynchus mykiss</i>		✓				✓	✓				✓		✓	✓
Threespine stickleback	<i>Gasterosteus aculeatus</i>			✓							✓		✓		✓
Sacramento perch	<i>Archoplites interruptus</i>					✓	✓	✓		✓	✓	✓	✓	✓	✓
Prickly sculpin	<i>Cottus asper</i>	✓	✓	✓			✓	✓			✓	✓	✓	✓	✓
Riffle sculpin	<i>Cottus gulosus</i>				✓										✓
Tule perch	<i>Hysterocarpus traski</i>	✓	✓	✓									✓		✓
Hardhead	<i>Mylopharodon conocephalus</i>														✓
Non-Native Species															
Goldfish	<i>Carassius auratus</i>										✓				✓
Carp	<i>Cyprinus carpio</i>						✓	✓		✓	✓	✓	✓	✓	✓
Golden shiner	<i>Notemigonus crysolencas</i>												✓		✓
White catfish	<i>Ameiurus catus</i>						✓								✓
Black bullhead	<i>Ameiurus melas</i>												✓		✓
Brown bullhead	<i>Ictalurus nebulosus</i>							✓	✓					✓	✓
Western mosquitofish	<i>Gambusia affinis</i>								✓		✓	✓	✓		✓
Inland silverside	<i>Menidia beryllina</i>												✓		✓
															continued

4. Environmental Setting and Impacts
5. Fisheries and Aquatic Habitat – Setting

Table 4.5.2 (continued)

Common Name	Scientific Name	1905 Synder	1927 Follet	1934 Seale	1938 Shapovalov	1953 Follett	1955 Follett	1957– 1958 Follett	1961 Hopkirk	1972 Follet	1973 CDFG	1977 Scoppettone and Smith	1984 Leidy	1998- 2004 SFPUC	2007 Leidy
Green sunfish	<i>Lepomis cyanellus</i>								✓		✓		✓	✓	✓
Bluegill	<i>Lepomis macrochirus</i>					✓	✓	✓				✓			✓
Smallmouth bass	<i>Micropterus dolomieu</i>					✓			✓				✓		✓
Largemouth bass	<i>Micropterus salmoides</i>												✓	✓	✓
Fathead minnow	<i>Pimephales promelas</i>													✓	✓
Unidentified sunfish														✓	✓

Sources: Gunther et al. 2000; ETJV 2008; SFPUC 2002a, 2002b, 2004a, 2005, and 2006b; and Leidy 2007

Species Occurrence, Distribution, and Relative Abundance in the Primary Study Area

The SFPUC has monitored the fish communities in the Alameda Creek watershed since 1998. The results of these surveys are summarized by stream study reach and presented in Table 4.5.3. As described above, the stream study reaches are defined as follows:

- Reach A-1: Alameda Creek from the outlet of Sunol Valley (approximately at the SFPUC Water Temple) upstream for about 3.5 miles;
- Reach A-2: Alameda Creek from about 0.5 mile downstream of the bridge near the entrance of the SVWTP to the confluence of Calaveras Creek;
- Reach A-3: Alameda Creek just upstream of the Calaveras Creek confluence, including the area of Little Yosemite;
- Reach A-4: Alameda Creek upstream of Little Yosemite to the ACDD;
- Reach A-5: Alameda Creek from the ACDD to Camp Ohlone;
- Reach A-6: Alameda Creek upstream of Camp Ohlone;
- Reach C-1: Calaveras Creek downstream of Calaveras Dam to the confluence with Alameda Creek;
- Reach C-2: Calaveras Creek upstream of Calaveras Reservoir; and
- Reach AH-1: Arroyo Hondo upstream of the upper storage elevation of Calaveras Reservoir.

Aquatic habitat conditions for each of the stream study reaches are described under “Aquatic Habitats” above.

The distribution of fish species in Alameda Creek is consistent with what would be expected based on recognized distinct assemblages or zones of fish that change from the headwaters down into the lower reaches of streams in a fairly consistent pattern (Moyle 2002). The upper reaches of Arroyo Hondo upstream of Calaveras Reservoir and Alameda Creek upstream of Calaveras Creek confluence support trout, the primary indicator species for cold/headwater habitat. Further, 10 percent of all samples (a sample is considered one habitat unit on one sampling date) in Alameda Creek upstream of the Calaveras Creek confluence (Reaches A-3 through A-5) contained rainbow trout as the only fish species present. It is likely that the steep gradient section of Alameda Creek upstream of the Calaveras Creek confluence (Reach A-3) plays some role in the occurrence and distribution of fish species in this reach. It is unlikely that any of the warm-water species have the swimming ability necessary to ascend through the Little Yosemite area into the upper portion of Alameda Creek, and their exclusion may favor rainbow trout through lack of competition and predation. In particular, pikeminnow are potential predators of juvenile trout. The presence of Pacific lamprey downstream of the Little Yosemite area, but not upstream, also suggests that the steep gradient may be a formidable barrier to the lamprey’s ability to migrate upstream.

Table 4.5.3 Relative Abundance of Fish Sampled During SFPUC Electrofishing Surveys (1998-2004) (Based on Catch at Sample Stations Within Each Reach)

Species	Reach A-2		Reach C-1 (Downstream of Calaveras Reservoir)	Reach C-2 (Upstream of Calaveras Reservoir)	Reach A-3	Reach A-4	Reach A-5	Reach AH-1
	Lower	Upper						
Rainbow trout	0%	0.1%	0%	1.5%	29.8%	4.1%	11.7%	4.9%
Prickly sculpin	0.1%	1.4%	10.6%	1.8%	0%	0%	0%	32.8%
Roach	77.2%	75.7%	80.1%	85.9%	70.2%	95.9%	88.3%	61.5%
Sacramento sucker	11.4%	12.9%	9.0%	8.6%	0%	0%	0%	0.8%
Sacramento pikeminnow	10.1%	6.1%	0.1%	2.2%	0%	0%	0%	0%
Pacific lamprey	1.1%	3.5%	0%	0%	0%	0%	0%	0%
Largemouth bass	0%	0.2%	0%	0%	0%	0%	0%	0%
Bluegill	0.06%	0%	0.1%	0%	0%	0%	0%	0%
<i>Note:</i> No data are provided for Reaches A-1 or A-6 because there are no sample stations located within these reaches. The lower Reach A-2 site is just upstream of the upstream limit of Reach A-1.								

Source: SFPUC data summarized in ETJV 2008

Prickly sculpin have been recorded in Arroyo Hondo (Reach AH-1), but have not been documented in Alameda Creek upstream of the Calaveras Creek confluence. Prickly sculpin are tolerant of a wide range of conditions and are present throughout the Sunol Wilderness reach (Reach A-2) of Alameda Creek as well as downstream of Niles Canyon (and likely within Niles Canyon). California roach, also tolerant of a wide range of conditions, have been reported in all reaches throughout the primary study area. Although roach were abundant everywhere, they were most dominant in upper Alameda Creek (both upstream and downstream of the ACDD; Reaches A-5 and A-4, respectively), making up 95.9 percent of individual fish downstream of the ACDD and 88.3 percent upstream of the ACDD (see Table 4.5.3). The abundance of roach and relatively low numbers of rainbow trout (together with the relatively high water temperature conditions) indicate that upper Alameda Creek may tend toward a warm-water headwater/intermittent type of habitat.

In Alameda Creek downstream of the Calaveras Creek confluence (Reach A-2), the fish community is dominated by species typical of warm-water, lower gradient streams, including Sacramento sucker and pikeminnow along with prickly sculpin and roach, with rainbow trout being observed only during a single snorkel survey just downstream of the Calaveras Creek

confluence in 1998 (SFPUC survey data summarized in ETJV 2008). Flows during the spring and summer of 1998 were the highest of any of the years when fish population monitoring has been conducted. The presence of pikeminnow in this reach may partially explain the near-absence of trout there, although habitat features (lower gradient, longer pools, lower incidence of boulder-dominated substrate, and warmer water temperatures) are likely also important factors. Largemouth bass and bluegill are occasionally found in this reach and may be derived from populations of these species resident in Calaveras Reservoir. They appear to be transients in this reach rather than part of a self-sustaining population.

Lamprey ammocetes (i.e., larval lamprey) have also been observed in Reach A-2 (Alameda Creek downstream of the Calaveras Creek confluence). Adult lampreys would have to ascend some formidable migration barriers to reach spawning habitat in upper Sunol Valley, including the BART weir and the PG&E gas pipeline crossing (drop structure), as well as more transitory obstacles such as the inflatable dams in the Alameda Creek flood control channel downstream of Niles Canyon. They are apparently able to surmount barriers by swimming until tired, then attaching themselves to the substrate using their mouths and resting. Alternatively, landlocked populations have become established throughout their range with both predatory and non-predatory populations. Moyle (2002) suggests the possibility that some upstream populations have individuals that remain resident, rather than going to sea, much like rainbow trout. There are no known reports of observations of either Pacific lamprey or river lamprey spawning in Alameda Creek and no recorded observations of lamprey attached to fish or scars on fish from lamprey attacks. If adult Pacific lamprey can ascend barriers in the lower creek and reach Sunol Wilderness, it is unclear how often they are successful at doing so. Although the exact duration of the immature phase is uncertain, ammocoetes may live for 3 to 7 years, filter-feeding in stream substrates, before transforming into the sea-going phase and migrating downstream (Moyle 2002).

Primary Factors Limiting Fish Populations in the Primary Study Area

A central issue related to both existing conditions and the proposed project is the condition of fish populations in the primary study area and the degree to which operation of Calaveras Dam and the ACDD may be limiting to fish populations downstream of these dams.

Moyle et al. (1998) have presented a three-tiered approach to defining “good condition” in the context of fish at the individual level, population level, and community level. At the **individual level**, most fish in a healthy stream environment should (1) have a robust body conformation, (2) be relatively free of diseases and parasites, (3) have growth rates reasonably near the optimum for the species, and (4) respond in an appropriate manner to stimuli. At the **population level**, each population must have (1) multiple age classes (evidence of reproduction), (2) a viable population size, and (3) healthy individuals (as above). Moyle et al. (1998) acknowledge that determination of viable population size is problematic and, therefore, has presented two surrogate indicators:

a) extensive habitat should be available for all life history stages, and b) all life history stages and the habitats they require should have a broad enough distribution within the system to sustain the species indefinitely. Finally, at the **community level**, a fish community in good health is one that (1) is dominated by co-evolved species, (2) has a predictable structure as indicated by limited niche overlap among the species and multiple trophic levels, (3) is resilient in recovering from extreme events, (4) is persistent through time, and (5) is replicated geographically. Moyle et al. (1998) characterize this as an assemblage of fish that will predictably inhabit a given set of environmental conditions.

Distribution and abundance of fish species within the Alameda Creek watershed is largely consistent with regional distribution of different species in habitat zones and habitat preferences of those species (ETJV 2008, pp. 34-35). The warm-water native fish community appears relatively healthy in the reach of Alameda Creek downstream of the Calaveras Creek confluence. Rainbow trout are not expected downstream of the Calaveras Creek confluence because the habitat conditions are more conducive to the lower gradient, warm-water fish community, although the 1997 MOU envisions altering those conditions through release of cold water from Calaveras Reservoir to favor establishment of a rainbow trout population. The extent of fish habitat downstream in Sunol Valley is limited by lack of streamflow during the summer. This is likely a natural condition, given the alluvial substrate in the valley and low summer streamflow present in both Arroyo Hondo and Alameda Creek under unimpaired conditions.

The species assemblage is dominated by co-evolved species, has a predictable structure, is replicated geographically in the region, and has been persistent through time. The greater occurrence of non-native species in the lower reaches of Alameda Creek (Niles Canyon and the flood-control reach downstream in the extended study area) is related to both the habitat conditions, including flow modifications, and perhaps the degree of alteration and disturbance in the surrounding watershed areas. There are not sufficient data to discuss the health of individual fish in these populations such as growth rates, body conformation, or incidence of disease. Rainbow trout in the watershed often exhibit a condition commonly known as black spot disease (BSD). BSD is indicated by external dark spots attributed to the resting stage of trematodes that encyst under the scales of fish. It is found in trout that inhabit warmer waters (the trematode requires temperatures above 18°C to complete its life history), but is not necessarily detrimental to the fish.

Rainbow trout are limited to upper watershed areas where they find suitable micro-habitat structure and substrate conditions along with cooler water temperatures. Exclusion of other fish species by the steep gradient upstream of Calaveras Creek may allow persistence of trout in the absence of predation and/or competition with other species. Even in these relatively cool upper watershed areas, water temperatures may be near the thermal limits for healthy rainbow trout. Rainbow trout density, in comparison to coastal streams in the central California coast region, is

relatively low throughout the watershed, possibly a reflection of the generally dryer and warmer local climate. Downstream of the Calaveras Creek confluence, trout are likely limited by less suitable micro-habitat and substrate conditions, warmer water temperatures, and the presence of other fish species, such as pikeminnow, that are known to prey on juvenile trout.

Anadromous species including steelhead are excluded from the study area by passage obstacles downstream in the flood-control (lower Alameda Creek) reach, Niles Canyon, and lower Sunol Valley. Anadromous species would also be limited to the relatively short reach of stream downstream of the Calaveras Creek confluence by difficult passage conditions in Alameda Creek due to its steep gradient upstream of Calaveras Creek (i.e., Little Yosemite). Chinook salmon are occasionally observed downstream of the BART weir, but they are not able to migrate above it. If migration barriers were absent, high temperature and low streamflow conditions during both the adult and juvenile migration periods would likely limit Chinook salmon production in most years.

Benthic Macroinvertebrates

BMI, a diverse community of organisms that include aquatic insects, aquatic worms, clams, snails, and freshwater shrimp, potentially inhabit the substrate (benthos) of streams. Characteristics of aquatic BMI communities can be indicative of hydrologic, geomorphic, water quality, and biotic conditions in a stream.

A pilot bioassessment was conducted in the spring of 2001 to provide a baseline characterization of the BMI community in upper Alameda Creek (Trihey & Associates, Inc. 2001). Sampling was conducted at four locations in Reach A-2 (SVWTP to Calaveras Creek confluence) and Reach A-3 (Calaveras Creek confluence to Little Yosemite) of Alameda Creek. Sample collection and processing was conducted in accordance with the California Stream Bioassessment Procedures recommended by CDFG (Harrington and Born 2000). BMI samples were collected from randomly chosen riffles in each of the four locations.

Analysis of these samples revealed differences in BMI taxa richness, taxa composition, and tolerance measures among sample sites and between sample reaches. The study concluded that, although findings were preliminary, observed patterns suggest that water quality and habitat conditions in portions of upper Alameda Creek do not support as diverse and balanced a community of BMI as could exist (due to low to moderate impairment). While habitat impairment does not appear to be extensive, there are indications of low to moderate disturbance in reaches downstream of the Calaveras Creek confluence (Reach A-2). Biological metrics related to taxa composition, tolerance values, and functional feeding groups suggest that habitat conditions for BMI are better in Reach A-3 (upstream of the Calaveras Creek confluence) and that moderate habitat disturbance in the downstream reaches could be a result of increased nutrient levels or the presence of fine sediment (Trihey and Associates, Inc. 2001).

Calaveras Reservoir Fish Communities

Calaveras Reservoir supports a mixture of native stream fishes and introduced species. The native fishes include species such as Sacramento sucker, rainbow trout, and roach, which are capable of inhabiting non-flowing habitats but require flowing streams for part of their life history, in particular for reproduction. These species use tributaries, primarily Arroyo Hondo, for spawning and early rearing. The introduced fishes include species such as largemouth bass and bluegill that typically use lakes, ponds, and other slack-water habitats with minimal flow for their entire life history. The introduced warm-water species have also been found in Arroyo Hondo and in Calaveras and Alameda Creeks downstream of Calaveras Dam, although they do not likely persist in these areas.

The reservoir is particularly important to the rainbow trout population in Arroyo Hondo. Juvenile trout migrate downstream to the reservoir, primarily in the spring (ETJV 2008; SFPUC 2004b, p. 11). In the reservoir, trout grow to relatively large size and return to Arroyo Hondo to spawn, primarily in the winter and early spring. During summer, potential habitat for trout exists in a relatively thin band in the lower thermocline or upper hypolimnion where the water temperature is relatively cool and DO concentration is relatively high³ (ETJV 2008, p. 36). When the reservoir is at low storage elevation, as it has been under DSOD storage restrictions, available habitat can become limited in the late summer and early fall. As discussed above, DO concentrations in the hypolimnion of Calaveras Reservoir are maintained through the use of the HOS installed in September 2005.

Sacramento sucker, Sacramento pikeminnow, California roach, and prickly sculpin have been captured during migrant fish trapping in lower Arroyo Hondo, and these species likely use the reservoir as well (SFPUC 2004b, p. 13; ETJV 2008, p. 36). Sacramento sucker likely use the reservoir in a way that is similar to the trout population's use, but are less limited by temperature and DO conditions.

4.5.1.2 SENSITIVE FISHERIES AND AQUATIC HABITATS

Subsection 4.5.1.2 Contents

Special-Status Fish Species

Steelhead/Rainbow Trout

Regulatory Status

Life History

Anadromous CCC Steelhead DPS

Migration

Spawning

Rearing

³ 20°C or less and at least 5 milligrams per liter (mg/L) DO and preferably 7 mg/L or higher.

Subsection 4.5.1.2 Contents

Continued

Rainbow Trout in Alameda Creek
Migration
Spawning
Rearing
Rainbow Trout in Calaveras Reservoir and Arroyo Hondo
Migration
Spawning
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Resident and Migratory Populations of Rainbow Trout and Steelhead in the Alameda Creek Watershed
Rainbow Trout/Steelhead Migration and Barriers
River Lamprey
Occurrence
Status and Life History
Sacramento Perch
Occurrence
Status and Life History
Sensitive Aquatic Habitats

Special-Status Fish Species

Special-status fish species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status fish species addressed in this section include:

- Species listed as threatened or endangered under the FESA or California Endangered Species Act (CESA);
- Species identified by NMFS or CDFG as species of special concern;
- Species fully protected in California under the California Fish and Game Code; and
- Species determined to have special status under the CEQA for the purposes of this EIR.

A total of four special-status fish species have the potential to occur in the Alameda Creek watershed, as described below (see Table 4.5.4). Central California Coast (CCC) steelhead distinct population segment (DPS, formerly evolutionary significant unit) is listed as threatened under FESA only, and at present occurs downstream of the BART weir, in the CDRP extended study area. None of the other species are listed as threatened or endangered under either FESA or CESA. Genetic testing suggests that the present self-sustaining populations of resident rainbow trout in Alameda Creek (including those fish that are present in Calaveras Reservoir and upstream tributaries) may be derived from migratory steelhead that were isolated in the upper part of the watershed by natural processes and by construction of dams and other passage obstacles (Nielsen 2003, NMFS 2004). This research found that these subpopulations were more similar to each

other and populations of anadromous steelhead within the central California coast region than to other populations of steelhead including several widely distributed hatchery strains. In June 2005, NMFS proposed designating resident rainbow trout in the Alameda Creek watershed as threatened due to genetic similarities between resident and anadromous steelhead; however, only anadromous populations were included in the January 5, 2006 final listing determination, which reaffirmed the threatened status of CCC steelhead DPS under FESA. Specifically, the final listing determination stated “under our final approach of delineating steelhead-only DPS of *O. mykiss*, the resident populations, including those in Upper Alameda Creek and the Livermore-Amador Valley, are not considered part of the listed DPSs” (71 Federal Register [FR] 841, January 5, 2006). Rainbow trout is typically not considered a special-status fish species; however, NMFS (2004), CDFG (2005, p. 1), and others (Leidy 2007, p. 106) have indicated the importance of conserving resident Alameda Creek watershed rainbow trout because their genetic similarities with the federally listed CCC steelhead DPS could contribute to the recovery of that species/DPS if a sustainable steelhead population is restored in Alameda Creek. Therefore, resident trout are considered special-status in this analysis for purposes of CEQA only, and not because of any regulation required by NMFS or CDFG.

Table 4.5.4: Special-Status Fish Species Known to Occur or Potentially Occurring in the CDRP Study Areas

Species	Status ¹		Habitat	Potential to Occur in the CDRP Study Areas
	NMFS	CDFG		
California Central Coast steelhead DPS <i>Oncorhynchus mykiss</i>	T	--	Requires cold, freshwater streams with suitable gravel for spawning; rears in rivers and tributaries, and in the San Francisco Bay.	Known to occur in Alameda Creek below BART weir in the extended study area. Potential for occurrence in the primary study area is currently restricted by downstream barriers. Species considered in both study areas as part of future cumulative analysis (discussed in Chapter 6, Section 6.2).
Rainbow trout ² <i>Oncorhynchus mykiss</i>	--	--	Requires cold, freshwater streams with suitable gravel for spawning; rears in rivers and tributaries.	Known to occur in Alameda Creek, Arroyo Hondo, Calaveras Creek upstream of Calaveras Reservoir, and Calaveras Reservoir within the primary study area.

(continued)

Table 4.5.4 (continued)

Species	Status ¹		Habitat	Potential to Occur in the CDRP Study Areas
	NMFS	CDFG		
River lamprey <i>Lampetra ayresi</i>	--	SSC	Requires cool, freshwater streams with suitable gravel for spawning.	Not expected to occur in the study areas. A river lamprey was reported in the watershed in 1966, but there are no recent occurrences. Potential for occurrence in the study areas is limited by downstream barriers.
Sacramento perch <i>Archoplites interruptus</i>	--	SSC	Spawning has been reported to extend from spring to late summer, depending on location and water temperature; among aquatic plants or congregating in shallow waters in schools among or near inshore vegetation.	Not expected to occur in the study areas. Records indicate that Sacramento perch historically occurred in Alameda Creek (ETJV 2008); no recent known occurrences in the study areas.
<i>Notes:</i> CDFG = California Department of Fish and Game; DPS = Distinct Population Segment; NMFS = National Marine Fisheries Service. ¹ Legal Status Definitions: <i>Federal Listing Categories:</i> T Threatened (legally protected) <i>State Listing Categories (CDFG):</i> SSC Species of Special Concern (no formal protection) ² Rainbow trout in the upper Alameda Creek watershed, including within and upstream of Calaveras Reservoir, are considered a special-status species because of genetic similarities to federally listed Central California Coast steelhead DPS and the potential for their contribution to the recovery of this DPS in the Alameda Creek watershed; however, rainbow trout are not considered part of the listed DPS.				

Source: Data compiled by EDAW in 2007

Two of the remaining species (river lamprey and Sacramento perch) are considered species of special concern by CDFG.

The four special-status species that are potentially supported by Alameda Creek are summarized below (ETJV 2008, pp. 36-49).

Steelhead/Rainbow Trout⁴

Regulatory Status

CCC DPS steelhead is a federally listed threatened species (NMFS 2006). Critical habitat, which was designated for this species by NMFS in February 2000, included the Alameda Creek watershed. However, in April 2002, NMFS withdrew the critical habitat designation pending further economic impact analysis. In September 2002, NMFS formally withdrew the critical habitat designation for CCC steelhead (NMFS 2002). In June 2004, NMFS proposed including resident rainbow trout in the CCC DPS due to genetic similarities between resident and migratory trout within the Alameda Creek watershed upstream of ACWD Inflatable Dam 1, an adjustable water diversion facility on Alameda Creek downstream of the mouth of Niles Canyon (NMFS 2004). NMFS subsequently determined that resident rainbow trout inhabiting Alameda Creek should not be included in the DPS for anadromous steelhead (NMFS 2006). Instead, NMFS determined to list as threatened only those anadromous forms of steelhead that exist downstream of the lowest impassable barriers in the Alameda Creek watershed (i.e., the BART weir). Thus, the resident rainbow trout that occur in the watershed upstream of the BART weir are not designated as a listed species nor proposed for listing.

Life History

Steelhead/rainbow trout "*O. mykiss*" have a dynamic life history. All *O. mykiss* hatch in the gravel substrate of cold-water streams. After hatching, the young fry emerge from the gravel and start feeding in the stream. Some begin to disperse downstream in the months following their emergence, but most continue to rear in the stream. Following a rearing period of at least 1 year, juveniles follow a variety of life-history patterns, including residents (nonmigratory) at one extreme and individuals that migrate to the open ocean (anadromous) at another extreme. Intermediate life-history patterns include fish that migrate within the stream (potamodromous), fish that migrate only as far as estuarine habitat, and fish that migrate to near-shore ocean areas.

Juveniles that become migratory typically do so after 1 or 2 years of rearing, but sometimes longer. Physiological changes in these fish (called smolts) ultimately allow them to make a transition from fresh water to sea water. Smolts migrate to the ocean, spend a variable amount of time there (typically 1 to 2 years), grow rapidly, and return to spawn, generally in the stream where they hatched. Steelhead are unusual among the other Pacific salmonids in that they do not all die after spawning. Some return immediately to the ocean, and others return after holding for a period in fresh water. Within a given stream, some *O. mykiss* do not migrate to the sea, and the proportion may vary considerably depending on local circumstances. These fish reach sexual

⁴ Rainbow trout and steelhead are the same species of trout (*O. mykiss*). The freshwater variety are rainbow trout, and trout that migrate from the ocean to spawn in freshwater (i.e., anadromous) are steelhead.

maturity and spawn without entering the ocean and are often known as resident or stream rainbow trout (Gunther et al. 2000).

Anadromous steelhead exhibit two basic life-history forms. Stream-maturing steelhead enter spawning streams before they are sexually mature, generally during the period between spring and early fall, and spend several months in the stream before they are ready to spawn. Ocean-maturing steelhead enter spawning streams during the fall and winter in a fully mature state and spawn relatively soon after entering freshwater (Gunther et al. 2000). Both forms may occur in the same river system with little or no genetic distinction. Details on the life history of steelhead that formerly inhabited the Alameda Creek watershed are unknown; however, the naturally occurring low summer flows and seasonally elevated water temperatures within many of the reaches may have limited opportunities for stream-maturing adult steelhead to have successfully over-summered in many areas. Steelhead habitat requirements are associated with distinct life-history stages, including migration from the ocean to inland reproductive and rearing habitats, spawning and egg incubation, rearing, and seaward migration of smolts and spawned adults. Habitat requirements and life-history timing can vary widely over the steelhead's natural range (Barnhart 1986, Pearcy 1992, and Busby et al. 1996, all cited in Gunther et al. 2000).

Temperature is an important factor affecting habitat quality and availability for migratory and resident trout, particularly during the over-summer rearing period (Gunther et al. 2000, Hanson Environmental 2002). The upper lethal temperature for Pacific salmonids is in the range 23.9 to 25°C for continuous long-term exposure (Gunther et al. 2000). Some researchers indicate an upper lethal temperature for Pacific salmonids as low as 22.9°C (Hanson Environmental 2002); however, steelhead can survive for short periods at elevated temperatures, especially if abundant food and DO exist. Recent temperature data suggest that summer and early-fall temperatures in Niles Canyon are within the range considered to be highly stressful or unsuitable for juvenile steelhead (Hanson Environmental 2002).

Anadromous CCC Steelhead DPS

As discussed above, steelhead, the ocean migratory form of *O. mykiss*, formerly inhabited the Alameda Creek watershed prior to construction of dams and other water resource development (Gunther et al. 2000, Leidy et al. 2005). The presence of migratory barriers, notably a grade control weir at the BART rail crossing, prevents upstream movement of steelhead to potential spawning and rearing habitat and steelhead can no longer complete their lifecycle in the watershed.

Migration: Steelhead along the central California coast enter fresh water to spawn when winter rains have been sufficient to raise streamflows. Increased streamflow during runoff events appears to provide a cue that stimulates migration and allows better conditions for fish to pass obstructions and shallow areas on their way upstream. The season for upstream migration of

steelhead adults lasts from late October through the end of May, but typically the bulk of migration occurs between mid-December and mid-April (Shapovalov and Taft 1954). Steelhead have strong swimming and leaping abilities that allow them to ascend streams into small tributary and headwater reaches. Anadromous steelhead are unique among Pacific salmon in that ocean migrating individuals may return to the ocean after spawning and return to freshwater to spawn one or more times.

Spawning: Steelhead select spawning sites with gravel substrate and with sufficient flow velocity to maintain circulation through the gravel and to provide a clean, well-oxygenated environment for incubating eggs. Preferred flow velocity is in the range of 1–3 feet per second (McEwan and Jackson 1996) and preferred gravel substrate is in the range of 0.25 to 4 inches in diameter (ETJV 2008). Typically, sites with preferred features for spawning occur most frequently in the pool tail/riffle head areas where flow accelerates out of the pool into the higher gradient section below. Survival of fertilized eggs through hatching and emergence from the gravel are most often limited by severe changes in flow that can dislodge eggs from the substrate, result in sedimentation, or de-water incubation sites.

Rearing: After emergence from the gravel, fry inhabit low-velocity areas along the stream margins. As they feed and grow they gradually move to deeper and faster water. The critical period for rearing juveniles is during base flow conditions that generally occur between May and October in central California. Steelhead populations in central California can occur in streams with relatively low base flow. Often, local populations thrive under conditions that may depart widely from species norms (ETJV 2008). Steelhead juveniles generally rear in freshwater environments for 1 to 2 years before undergoing the smoltification process that physiologically prepares the fish for life in salt water. In Alameda Creek, emigrating steelhead smolts are expected to migrate downstream between March and June, with older fish (ages 2 and 3) generally migrating earlier (March and April) and younger fish (age 1) migrating later (May and June). Food and cover are key factors for rearing steelhead (ETJV 2008, Shapovalov and Taft 1954).

Rainbow Trout in Alameda Creek

Resident rainbow trout are known to occur in the Alameda Creek watershed, including portions of Alameda Creek in the primary study area (see additional discussion below).

Migration: Resident rainbow trout populations exhibit a range of migratory behavior. Habitat for spawning, juvenile rearing, and adult trout is not evenly distributed in the study area. Good spawning habitat exists in some stream reaches that become intermittent or dry during summer. Seasonal movements may be important for dispersal of young-of-year fish from spawning areas to prime rearing areas and for adults moving from over-summer habitat to spawning areas. Parts of the stream become very warm or go dry during summer months while other reaches support

deep pools and springs providing thermal refugia during the summer. Catastrophic events may result in loss of fish from some areas that are re-colonized by migration from other areas.

Spawning: Non-anadromous rainbow trout spawning behavior is similar to steelhead behavior except that resident trout, because they are often physically smaller in size, will often use smaller spawning gravel in the range of 0.25 to 2.5 inches in diameter, slightly lower water velocities, and shallower spawning water depths.

Rearing: The most critical period for rainbow trout rearing in the watershed is during the warm dry season between May and September. During this period streamflow declines to minimal levels and water temperature increases. Trout persist in perennial stream reaches and in isolated pools sustained by subsurface flows during this period.

Rainbow Trout in Calaveras Reservoir and Arroyo Hondo

Landlocked rainbow trout populations are known to exist in Calaveras Reservoir and upstream tributaries including Arroyo Hondo and, to a lesser extent, Calaveras Creek upstream of the reservoir (see additional discussion below).

Migration: Adult rainbow trout leave the reservoir and enter Arroyo Hondo in the spring (ENTRIX 2003, SFPUC 2004b). The majority of trout moved upstream in February and March during trapping studies conducted in 2002 and 2003. Trout returning to the reservoir appear to peak in late March and April, although some fish have returned as late as June.

Both adult and juvenile migrating rainbow trout must pass through the exposed sediment wedge in the reservoir drawdown zone. Under DSOD-restricted operations this is a relatively long section of channel with no riparian canopy and, in some areas, sections of shallow braided channel. Migrating fish are potentially exposed to shallow riffles with difficult passage, increased predation, and warm water temperature, particularly for adult fish and juveniles migrating to the reservoir in late spring and early summer (SFPUC 2005). The section of Arroyo Hondo accessible to the reservoir trout population is limited by a large landslide approximately 0.8 mile upstream of the Marsh Road bridge. The falls associated with this slide had been determined to be impassable to upstream migrating steelhead or resident rainbow trout in a recent assessment (URS and HDR 2009). There is some habitat in Calaveras Creek that is potentially usable by this population, but the stream channel has been obliterated in the Calaveras Reservoir drawdown zone and there is likely only a connection at times of high streamflow and/or high reservoir elevation.

Spawning: The only spawning habitat for this population is in Arroyo Hondo between Calaveras Reservoir and the major slide about 0.8 mile upstream of Marsh Road. Some potential spawning habitat exists in Calaveras Creek upstream of the reservoir; however, it is rarely, if

ever, accessible under current conditions. The self-sustaining reservoir population may also be supported in part by recruitment of upstream progeny both from Arroyo Hondo and from Alameda Creek through the diversion tunnel from the ACDD.

Rearing: The only juvenile rearing habitats for this population are in Arroyo Hondo between Calaveras Reservoir and the major slide about 0.8 mile upstream of Marsh Road, and in Calaveras Reservoir. A small amount of suitable rearing habitat also exists in Calaveras Creek upstream of the reservoir, but the habitat is rarely, if ever, accessible due to hydrologic, stream channel, and reservoir elevation conditions.

Resident and Migratory Populations of Rainbow Trout and Steelhead in the Alameda Creek Watershed

Populations of resident rainbow trout occupy habitats in upper Alameda Creek, Calaveras Reservoir, and Arroyo Hondo in the primary study area (Leidy 1984, ETJV 2008). Young-of-year *O. mykiss* have been observed in Stonybrook Creek and Sinbad Creek, tributaries to the Niles Canyon reach of Alameda Creek (extended study area) (Gunther et al. 2000). However, electrofishing in Sinbad Creek in 1997 and 1998 failed to capture any *O. mykiss*. Stonybrook Creek is regarded as potential *O. mykiss* habitat based on the presence of several age classes of resident individuals, including young-of-year (Gunther et al. 2000).

There is some evidence that a native, locally adapted *O. mykiss* stock survives in the Alameda Creek watershed (Gunther et al. 2000). Resident rainbow trout were collected below Niles Dam in 1927 and in Stonybrook Creek in 1955. Sampling by the ACWD in 1999 documented the presence of reproducing populations of resident trout in Arroyo Mocho and two tributaries to upper Alameda Creek, Welch, and Pirate Creeks (Gunther et al. 2000). Recent sampling by the EBRPD documented the presence of reproducing trout populations in Stonybrook Creek and upper Alameda Creek in the Sunol Wilderness (Gunther et al. 2000).

Sightings of steelhead have been reported downstream of the BART weir. However, habitat conditions downstream of the BART weir are considered unsuitable for successful steelhead spawning and juvenile rearing. As discussed above, the presence of migratory barriers, notably a grade control weir at the BART rail crossing, prevents upstream movement of steelhead to potential spawning and rearing habitat and steelhead cannot complete their lifecycle in the watershed.

In 1998 and in subsequent years (i.e., 1999, 2006, and 2008), individual steelhead were captured downstream of the BART weir by local government agencies and citizen groups and released in the mouth of Niles Canyon upstream of the lower Alameda Creek barriers or in the mouth of

Stonybrook Creek.⁵ One of the 1998 fish, a gravid female, was tracked to Stonybrook Creek, upstream of Niles Dam (Gunther et al. 2000). There are also reports of steelhead spawning in Alameda Creek downstream of the ACWD middle inflatable dam, and in 1998 fertilized eggs were collected from this area immediately downstream of the BART weir. The eggs hatched successfully and the resulting fry were released into Alameda Creek in the Sunol Wilderness (Gunther et al. 2000). In February 2008, two adult steelhead were captured downstream of the BART weir and released in Niles Canyon; the two fish were later documented (March 2 and 3, 2008) exhibiting spawning behavior in Stonybrook Creek. These few individual fish that have been relocated upstream of the BART weir have not created a self-sustaining population as they cannot reach the above-weir habitat every year, may or may not be successfully spawning due to low numbers of adult fish and other passage barriers upstream, and face overall limited habitat conditions (for spawning, egg incubation, and juvenile rearing).

Genetic testing suggests that the present self-sustaining populations of resident rainbow trout in Alameda Creek (including those fish that are present in Calaveras Reservoir and upstream tributaries) are derived from migratory steelhead that were isolated in the upper part of the watershed by natural processes and by construction of dams and other passage obstacles (Nielsen 2003, NMFS 2004). This research was based on small sample size but found that these subpopulations were more similar to each other and populations of anadromous steelhead within the central California coast region compared to other populations of steelhead, including several widely distributed hatchery strains.

Rainbow Trout/Steelhead Migration and Barriers

As described above, Alameda Creek historically hosted a steelhead population, with spawning occurring in the upper reaches of the watershed (Gunther et al. 2000, McBain and Trush 2008). That steelhead population was eliminated by the placement of several obstructions to migration within the Alameda Creek channel over the past century. These obstructions include the ACFCWCD BART weir, located about 9.5 miles upstream from the creek's confluence with San Francisco Bay; ACWD inflatable dams (ranging in location from about 2 miles upstream of the San Francisco Bay to just below Niles Canyon); the USGS gaging station weir in Niles Canyon; and the PG&E gas pipeline drop structure in Sunol Valley (see Figure 4.5.2: Major Facilities and Fish Passage Barriers/Obstacles in the Alameda Creek Watershed). In addition, the Calaveras Dam, San Antonio Dam, and ACDD (all owned by the CCSF and operated by the SFPUC) and Del Valle Dam (owned and operated by the California Department of Water Resources) are all impassable barriers in the upper part of the watershed. Calaveras Dam is 210 feet high and the ACDD is 31 feet high, and fish passage structures do not exist at the dams. Thus, both dams are considered impassable barriers for fish migration (Gunther et al. 2000, p. 32). The SFPUC

⁵ The number of steelhead that were captured and released upstream by year is as follows: 1998 – four fish, 1999 – three fish, 2006 – six fish, and 2008 – two fish (Alameda Creek Alliance 2009).

removed above-ground portions of two relic diversion dams located on Alameda Creek (Sunol Dam and Niles Dam) in September 2006 to benefit fish habitat. Other migration barriers along the creek also have been or are in the process of being removed; two swimming hole dams in the Sunol Wilderness were removed in the past few years, and the ACWD is evaluating plans to remove or provide fish passage at its inflatable dams and is currently installing a fish screen on an unscreened diversion from the creek.

Despite the recent removal of these structures, currently steelhead can migrate upstream only as far as the BART weir in the lower extent of the extended study area. Steelhead will not have access to the primary study area until passage is provided at the remaining downstream barriers to fish migration. The locations of passage obstacles/barriers within the watershed downstream of Calaveras Reservoir and the ACDD, as shown in Figure 4.5.2, are as follows:

- ACWD lower inflatable dam;
- ACFCWCD BART weir – considered the most important impediment to fish passage;
- ACWD middle and upper inflatable dams;
- USGS Niles gaging station weir/concrete apron; and
- PG&E gas pipeline concrete apron drop structure.

The status of planning to address passage at these locations is described in Section 6.2, Cumulative Impacts, in Chapter 6, Other Topics Required by CEQA.

The SFPUC also is conducting preliminary studies of the following passage issues in the watershed: (1) natural barriers in the watershed, including the landslide in the Arroyo Hondo above Calaveras Reservoir, and the Little Yosemite reach of Alameda Creek; (2) Calaveras Dam; (3) the ACDD; and (4) critical riffles on Alameda Creek, focusing on the Sunol Valley/Quarry reach (Reach A-1).

River Lamprey

Occurrence

River lamprey (*Lampetra ayresi*) have been reported from a single collection in Alameda Creek (ETJV 2008). Records exist for river lamprey in other San Francisco Bay tributaries and their occurrence in Alameda Creek is possible (ETJV 2008). Lamprey larvae, identified as Pacific lamprey, have been captured regularly in Alameda Creek downstream of the Calaveras Creek confluence in electrofishing surveys between 1998 and 2004. It is difficult to distinguish the larval and early adult life stages of river lampreys from Pacific lampreys because the morphologies of these life stages are very similar (ETJV 2008). River lampreys can feed in fresh water, and a landlocked population may exist in upper Sonoma Creek (Moyle 2002).

Status and Life History

River lamprey is on the CDFG Watch List. River lamprey have received little scientific attention and there is uncertainty regarding their status and biology. River lamprey are anadromous with a free-swimming parasitic marine adult stage and a freshwater immature stage that is a benthic filter feeder. Ammocoetes (larval forms) may be free-swimming or burrow in sand or muddy substrates in quieter channel margin habitats. It is assumed that high water quality and temperatures not exceeding 25°C are preferred (ETJV 2008).

Sacramento Perch

Occurrence

Sacramento perch were collected in Calaveras Reservoir in 1943 as documented in museum collections (Leidy 1984). Sacramento perch are native to California, but there is some question about whether they are native to Alameda Creek (Gunther et al. 2000). Moyle (2002) regards them as native to Alameda Creek; however, early fish collections did not note the presence of Sacramento perch in Alameda Creek although other native stream species were present (Leidy 1984). They were documented in 1953 in the dredger ponds near Niles along with non-native smallmouth and largemouth bass. Aceituno et al. (1976) believed that Sacramento perch were stocked into Calaveras Reservoir sometime after 1925 and spread to the stream from there. However, Gobalet (1990) reports Sacramento perch were found among fish remains at an archaeological site adjacent to Arroyo de la Laguna. EBRPD staff has seen Sacramento perch in surveys of the off-channel percolation ponds adjacent to the flood control channel; however, extensive surveys of all these ponds have failed to find them in recent years (ETJV 2008).

In November 2003, a group from the University of California at Davis sampled Calaveras Reservoir, using boat electrofishing to collect Sacramento perch for genetic analysis. Largemouth bass and bluegill were the principal species caught; no Sacramento perch were caught (ETJV 2008).

Status and Life History

The Clear Lake population of Sacramento perch is a CDFG Species of Special Concern. Populations outside the native range are on the CDFG Watch List. Historically, Sacramento perch were found throughout the Central Valley, the Pajaro and Salinas Rivers, and Clear Lake at elevations below 100 meters (Moyle 2002). It is the only native centrarchid (sunfish) in California. They are no longer present in most of their native habitat, but they maintain populations where they have been introduced in reservoirs and farm ponds. Their native habitat includes sloughs, slow-moving rivers, and lakes (Moyle 2002). Waters originally inhabited by the Sacramento perch have fluctuated tremendously with floods and droughts, and these fish are able to withstand low water clarity, high temperatures, and high salinities and alkalinities. Most

populations today are established in warm (summer temperatures of 18°C to 28°C), turbid, moderately alkaline reservoirs or farm ponds.

Sensitive Aquatic Habitats

Sensitive habitats include those that are of special concern to resource agencies or that are afforded specific consideration through FESA, CEQA, Section 1602 of the California Fish and Game Code, Porter-Cologne Water Quality Control Act, Section 404 of the Clean Water Act (CWA), or the Sustainable Fisheries Act (as amended).

Open water and associated riparian habitat are protected under the Fish and Game Code and/or CWA. In addition, the lowermost portion of Alameda Creek (downstream of the BART weir in the lower portion of the extended study area) has also been designated as Essential Fish Habitat (EFH) by the Pacific Fishery Management Council (Pacific Fishery Management Council 2003) to protect and enhance habitat for coastal marine fish and macroinvertebrate species that support commercial fisheries. EFH is defined as waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity.

4.5.1.3 REGULATORY FRAMEWORK

Subsection 4.5.1.3 Contents

Federal Regulations

- Federal Endangered Species Act
- Sustainable Fisheries Act
- Section 404 of the Clean Water Act
- Section 401 of the Clean Water Act
- Fish and Wildlife Coordination Act

State Regulations

- California Endangered Species Act
- California Fish and Game Code
 - Section 1602
 - Sections 5900–6100

Local and Regional Regulations

- Alameda County East County Area Plan
 - Biological Resources
- Santa Clara County General Plan
 - Resource Management and Conservation
 - Habitat and Biodiversity
 - Riparian and Freshwater Habitats

Federal, state, and local agencies have regulatory authority or responsibility over activities that affect fisheries and aquatic resources. The regulatory authorities, agreements, and plans relevant to the regulatory setting are discussed below.

Federal Regulations

Federal Endangered Species Act

Under FESA, the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered (16 U.S. Code [USC] 1533[c]). USFWS has jurisdiction over plants, wildlife, and resident fish, while NMFS has jurisdiction over anadromous fish and marine fish and mammals. FESA is discussed in Subsection 4.4.1.3, Regulatory Framework, in Section 4.4, Vegetation and Wildlife.

On January 5, 2006, the CCC DPS, including all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers, were listed as threatened under FESA by NMFS (71 FR 834). The SFPUC is required to obtain a CWA Section 404 permit from the U.S. Army Corps of Engineers (USACE) to construct the CDRP. Before issuing a Section 404 permit, the USACE is required under Section 7 of FESA to consult with NMFS and/or USFWS if a federally listed species may be affected by a proposed project to be permitted. The USACE has entered into Section 7 discussions with NMFS to address potential impacts on listed steelhead.

Sustainable Fisheries Act

In response to growing concern about the status of U.S. fisheries, the Sustainable Fisheries Act of 1996 (Public Law 104-297) was passed by Congress to amend the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265), the primary law governing marine fisheries management in the federal waters of the United States. Under the Sustainable Fisheries Act, consultation is required by NMFS on any activity that might adversely affect EFH. EFH includes those habitats that fish rely on throughout their life cycles. It encompasses habitats necessary to allow sufficient production of commercially valuable aquatic species to support a long-term sustainable fishery and contribute to a healthy ecosystem. Alameda Creek has been designated as EFH downstream of the primary study area.

Section 404 of the Clean Water Act

Section 404 of the federal CWA establishes a requirement for a project applicant to obtain a permit before engaging in any activity that involves any discharge of dredged or fill material into “waters of the United States,” including wetlands. Section 404 is discussed in Subsection 4.4.1.3, Regulatory Framework, in Section 4.4, Vegetation and Wildlife.

Section 401 of the Clean Water Act

CWA Section 401(a)(1) specifies that any applicant for a federal license or permit to conduct any activity that may result in any discharge into navigable waters shall provide the federal licensing

or permitting agency with a certification that any such discharge will not violate state water quality standards. Section 401 is discussed in Subsection 4.4.1.3, Regulatory Framework, in Section 4.4, Vegetation and Wildlife.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) (16 USC 661–666c), as amended, requires federal agencies to consult with USFWS, NMFS, and state fish and wildlife resource agencies before undertaking or approving projects that control or modify surface water. FWCA provides that, whenever any water body is proposed to be controlled or modified “for any purpose whatever” by a federal agency or by any “public or private agency” under a federal permit or license, the action agency is required first to consult with the wildlife agencies, “with a view to the conservation of fish and wildlife resources in connection with that project” (16 USC 662[a]). FWCA provides that wildlife conservation receive equal consideration to other project objectives and is coordinated with other aspects of water resources development (16 USC 661). Recommendations made by these agencies must be fully considered in project plans by federal agencies.

State Regulations

California Endangered Species Act

Pursuant to CESA and Section 2081 of the California Fish and Game Code, a permit from CDFG is required for projects that could result in the take of a state-listed threatened or endangered species. CESA is described in Subsection 4.4.1.3, Regulatory Framework, in Section 4.4, Vegetation and Wildlife. There are no fish species state listed as threatened or endangered in the CDRP study area.

California Fish and Game Code

Section 1602

All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFG under Section 1602 of the California Fish and Game Code. Section 1602 of the Fish and Game Code is discussed in Subsection 4.4.1.3, Regulatory Framework, in Section 4.4, Vegetation and Wildlife.

Sections 5900–6100

Sections 5900–6100 of the California Fish and Game Code pertain to dams, conduits, and screens and impediments to fish passage. No permit for the project is required in relation to compliance with these sections of the code; some comments received during the scoping process asked that

the project consider removal of impediments to fish passage (see Subsection 1.8, Areas of Controversy and Issues to Be Resolved, in Chapter 1, Executive Summary). Some of these provisions are relevant to existing Calaveras Dam operations. Section 5937 requires sufficient flows to be released through a fishway or over, through, or around a dam to keep in good condition any fish that may be planted or exist downstream of the dam. Flows established in a 1997 agreement between CDFG and the SFPUC, and as implemented through the proposed project, are intended to comply with this requirement (see below).

Section 5981 authorizes CDFG to require installation of fish screens for diversions greater than 250 cfs “when, in the opinion of the [CDFG] a screen is necessary to prevent fish from passing into a conduit.” The cost of these screens is split equally between the project owner and CDFG. If diversions are less than 250 cfs, Sections 6020-6028 provide for screens to be installed at CDFG expense, with the owner required to provide access rights for installation purposes.

Local and Regional Regulations

Alameda County East County Area Plan

The *Alameda County General Plan* is divided into geographical areas. The proposed project is located in the area covered by the *Alameda County East County Area Plan* (ECAP). The ECAP includes several policies protecting biological resources that are relevant to the proposed project. The applicable ECAP biological resources provisions are as follows:

Biological Resources

Goal: To preserve a variety of plant communities and wildlife habitat.

Policies

Policy 123: Where site-specific impacts on biological resources resulting from a proposed land use outside the Urban Growth Boundary are identified, the County shall encourage that mitigation is complementary to the goals and objectives of the ECAP. To that end, the County shall recommend that mitigation efforts occur in areas designated as "Resource Management" or on lands adjacent to or otherwise contiguous with these lands in order to establish a continuous open space system in East County and to provide for long term protection of biological resources.

Policy 124: The County shall encourage the maintenance of biological diversity in East County by including a variety of plant communities and animal habitats in areas designated for open space.

Policy 125: The County shall encourage preservation of areas known to support special-status species.

Policy 126: The County shall encourage no net loss of riparian and seasonal wetlands.

Policy 129: The County shall protect existing riparian woodland habitat present along the Arroyo Mocho, Arroyo Del Valle, Arroyo Las Positas, Arroyo de la Laguna; and Alamo, Tassajara, and Alameda Creeks. Exceptions to these requirements shall apply for those portions of the Arroyo del Valle to be excavated for water transfer Lakes A and B under the Specific Plan for the Livermore-Amador Valley Quarry Area Reclamation, which shall instead be subject to riparian habitat restoration as specified by Policies 128 and 164; and for any approved quarry operations in Regionally Significant Construction Aggregate Resource Sector C (Arroyo Mocho) or any other streambeds, which shall also be subject to habitat restoration under Policies 128 and 164, and according to applicable State Public Resources Code requirements, to the extent that proposed reclamation specifies riparian habitat as the end use.

Policy 52: The County shall preserve open space areas for the protection of public health and safety, provision of recreational opportunities, production of natural resources (e.g. agriculture, windpower, and mineral extraction), protection of sensitive viewsheds, preservation of biological resources, and the physical separation between neighboring communities.

Santa Clara County General Plan

Resource Management and Conservation

R-RC 3

Multiple uses of public lands intended for open space and conservation shall be encouraged so long as the uses are consistent with the objectives of resource management and conservation. For resources of critical concern, such as habitat for threatened or endangered species, priority shall be given to conservation of the resource.

Habitat & Biodiversity

R-RC 19

Habitat types and biodiversity within Santa Clara County and the region should be maintained and enhanced for their ecological, functional, aesthetic, educational, medicinal, and recreational importance.

Riparian and Freshwater Habitats

R-RC 31

Natural streams, riparian areas, and freshwater marshes shall be left in their natural state providing for percolation and water quality, fisheries, wildlife habitat, aesthetic relief, and educational or recreational uses that are environmentally compatible. Streams which may still

provide spawning areas for anadromous fish species should be protected from pollution and development impacts which would degrade the quality of the stream environment.

R-RC 32

Riparian and freshwater habitats shall be protected through the following general means:

- a. setback of development from the top of the bank;
- b. regulation of tree and vegetation removal;
- c. reducing or eliminating use of herbicides, pesticides, and fertilizers by public agencies;
- d. control and design of grading, road construction, and bridges to minimize environmental impacts and avoid alteration of the streambed and stream banks (freeway bridges and arch culverts, for example); and
- e. protection of endemic, native vegetation.

R-RC 33

Public projects shall be designed to avoid damage to freshwater and stream environments.

4.5.2 IMPACTS

4.5.2.1 SIGNIFICANCE CRITERIA

The CCSF has not formally adopted significance standards for biological resources impacts but generally considers that implementation of the proposed project would have a significant effect on fisheries and aquatic habitat if it were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFG, or USFWS;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any local policies or ordinances protecting fisheries or aquatic resources; or
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

4.5.2.2 APPROACH TO ANALYSIS

The analysis of impacts on fisheries and aquatic habitat focuses on special-status fish species and the aquatic habitat in the study area. As described in Subsection 4.5.1.2, Sensitive Fisheries and Aquatic Habitats, while several native fish species are present, there are no federal or state listed special-status fish species in Alameda or Calaveras Creeks in the primary study area. Although

not listed, the native rainbow trout present in Alameda Creek and Calaveras Reservoir is considered a special-status species for purposes of this Draft EIR. The impact analysis considers the presence, distribution, and abundance of special-status fish species in areas potentially affected by the proposed project; aquatic habitat conditions and habitat suitability for the resident rainbow trout; relationships between streamflow and relevant life stage habitat suitability, including suitability for rearing, spawning, and migration (fish passage); and factors that presently limit fish populations. Evaluation of project-related effects regarding the maintenance of fish populations included criteria for the individual level, population level, and community level as presented by Moyle et al. (1998).

CCC steelhead DPS are found in the Alameda Creek watershed. However, because steelhead access does not currently exist and there is no current steelhead migration upstream of the BART weir, there would be no impact on steelhead migration, spawning, or juvenile rearing upstream of the BART weir as a result of implementation of the proposed project as compared to existing conditions. A number of steps are required before steelhead migrate further upstream (into the primary study area). Thus, the impact analysis developed in this section addresses potential project-related effects on steelhead in the extended study area only. But, additional analysis of potential future project-related cumulative effects on steelhead in both the primary and extended study areas is provided in Section 6.2, Cumulative Impacts, in Chapter 6, Other Topics Required by CEQA. This cumulative analysis assumes that downstream barriers to steelhead access have been remedied and steelhead have access to the watershed. It then evaluates the project contribution to any cumulative impacts on steelhead under this future cumulative condition.

The SFPUC is proposing to implement flow releases consistent with the flow criteria described in the 1997 MOU to support native fishes in Alameda Creek as part of the proposed project. As further presented in Section 3.6.5, Resident Rainbow Trout Flow Releases, flows would be provided through the proposed ACDD bypass tunnel whenever sufficient water is available in Alameda Creek and water would be released from Calaveras Reservoir through the proposed low-flow release valves during dry periods to meet the MOU flow and temperature criteria. Because the flow releases described in Section 3.6.5 are proposed as part of the project, the impact analysis below assumes their implementation under the future operations of the CDRP.

In addition to the Resident Trout Flow Releases, which were developed to support resident rainbow trout, the SFPUC also proposes to implement flow release schedules to support steelhead in the watershed in the future when steelhead have regained access upstream of the BART weir as determined by NMFS as further described in Section 3.6.6, Steelhead Flow Releases. Although the steelhead flow releases would also benefit resident rainbow trout and other native fishes in the watershed, implementation of these additional flow releases will only occur when steelhead regain access upstream of the BART weir. Because restoring steelhead access to the watershed requires actions that are outside of the control of the SFPUC, the timing and implementation of

the proposed Steelhead Flow Releases is uncertain. Therefore, for purposes of providing a conservative, worst-case disclosure of the potential effects of the CDRP on native fishes currently present in the watershed, implementation of the Steelhead Flow Releases is not assumed in the impact analysis below.

Impacts on fisheries and aquatic habitat that could result from project construction activities were qualitatively evaluated based on the design and construction elements of the proposed project. Impacts that could result from project operations were quantitatively and qualitatively evaluated based on proposed project-related changes in releases from Calaveras Dam, diversions from the ACDD, and management of Calaveras Reservoir levels.

4.5.2.3 PROJECT IMPACTS

Table 4.5.5 summarizes the project-related impacts on fisheries and aquatic resources described in this section. Information on impacts is presented in two subsections, construction impacts and operational impacts. Information on operational impacts is presented as operations during the construction period and operations during reservoir filling and normal operations.

Table 4.5.5: Summary of Fisheries Resources Impacts

Impact		Level of Significance
4.5.1:	Construction-related effects on fish occupying habitat in Calaveras Creek downstream of the existing dam.	LSM
4.5.2:	Construction-related permanent loss of fish habitat in Calaveras Creek downstream of the existing dam.	LS
4.5.3:	Effect of project on creating barriers to fish movement/migration upstream in Calaveras and Alameda Creeks.	NI
4.5.4:	Temporary effects on fisheries resources related to increases in sediments and turbidity and to release of and exposure to contaminants.	LSM
4.5.5:	Effects on native fish in Alameda Creek from the ACDD downstream to the confluence with Calaveras Creek.	LSM
4.5.6:	Effects on native fish in Calaveras Creek below Calaveras Dam and in Alameda Creek downstream of the confluence with Calaveras Creek in the primary study area.	LS
4.5.7:	Effects of project operations on fish habitat in Calaveras Reservoir and in streams upstream of the replacement dam.	B
4.5.8:	Effects of project operations on native fish in Alameda Creek in the extended study area.	LS
4.5.9:	Potential for conflict with local plans protecting fisheries and aquatic habitat.	LSM
<i>Notes:</i> B – Beneficial NI – No impact LSM – Less than significant with mitigation LS – Less than significant		

Construction Impacts

Construction impacts include all those direct and indirect impacts on fish and their habitat that could result from project construction activities. Project construction activities were evaluated based on the dam relocation footprint and potential disturbance that could result from construction activities (e.g., excavation, grading, placement of material, potential release of contaminants).

Impact 4.5.1: Construction-related effects on fish occupying habitat in Calaveras Creek downstream of the existing dam.

The replacement dam would be constructed directly downstream of the existing dam, in a portion of the creek bed. No special-status fish species, including resident rainbow trout, have been documented in this reach (C-1) of Calaveras Creek (ETJV 2008, pp. 36-49). However, resident rainbow trout may have been entrained in spills (prior to DSOD-restricted conditions, after which no spills occurred) or cone valve releases and may have survived in the creek (Sak, pers. com., 2008). (Other native species may have been similarly affected.) If any of the life stages of rainbow trout were to be found in the approximately 945 linear feet of perennial stream at the time that excavation and dewatering for the replacement dam foundation begins, these construction activities would have a direct effect (injury or mortality) on this special-status species. This would be a potentially significant impact.

In accordance with Mitigation Measure 5.5.1, before construction activities commence downstream of the existing dam, a qualified biologist would conduct native fish relocation activities within approximately 100 feet of the limit of work area. All captured native fish species would be immediately released to a suitable habitat near the project site (identified by the biologist). The biologist would place block nets with 1/8-inch mesh at the downstream extent of the fish removal area to keep fish out of the area during fish removal activities and subsequent dewatering and construction activities. Thus, direct impacts on fish would be avoided.

Impact Conclusion

With the implementation of Mitigation Measure 5.5.1, potential impacts during construction of the replacement dam on native fish occupying the dam construction area would be less than significant.

Impact 4.5.2: Construction-related permanent loss of fish habitat in Calaveras Creek downstream of the existing dam.

As noted in Impact 4.5.1, the replacement dam would be constructed directly downstream of the existing dam, within an approximately 945-linear-foot section of Calaveras Creek. Thus, construction would result in the permanent loss of this amount of perennial stream and its

associated aquatic habitat. The habitat in this area is considered marginal for resident rainbow trout, however. It is a steep rocky gorge with bedrock and large boulders that make it less attractive for resident rainbow trout (see Reach C-1, in Subsection 4.5.1.1, Existing Conditions). The section of Calaveras Creek that would be lost has been heavily altered by construction of the original dam, and its natural character has been changed by decades of dam operation by the SFPUC, including loss of substrate and limited appropriate biotic resources.

This specific section of Calaveras Creek, within the proposed footprint of the replacement dam, has not been surveyed to determine fish species present. However, a site in Calaveras Creek just downstream of the proposed construction area has been surveyed (SFPUC fish sampling data summarized in ETJV 2008). Only those species that are common to the watershed were found, including California roach, Sacramento sucker, prickly sculpin, pikeminnow, and bluegill (see Table 4.5.3). No rainbow trout have been sampled in Calaveras Creek. This information supports the conclusion that the area immediately downstream of the existing dam that would be lost by construction is marginal habitat for rainbow trout.

Impact Conclusion

The permanent loss of 945 linear feet of marginal quality aquatic habitat in this relatively small section of creek would not result in a substantial reduction in habitat in the watershed, an adverse effect on the special-status fish species or a substantial change in the fish community of the watershed. Therefore, the impact would be less than significant.

Impact 4.5.3: Effect of project on creating barriers to fish movement/migration upstream in Calaveras and Alameda Creeks.

The replacement dam would be a barrier to fish migration of similar magnitude to the existing dam. Because of its size, the replacement dam, like the existing dam, would be a permanent impassible barrier to fish migration in Calaveras Creek and the presence of the existing ACDD would continue to be an impassable barrier to fish migration in Alameda Creek.

Calaveras Replacement Dam

The proposed 210-foot-high replacement dam, like the existing dam (also 210 feet high), would be an impassable barrier to fish passage. No facilities or provisions for fish passage are proposed; therefore, the proposed replacement dam would not change the extent to which fish passage or migration is impeded by the existing dam. Thus, there is no change created by the proposed project as compared to the existing condition in regard to fish passage.

Alameda Creek Diversion Dam

The existing ACDD is 31 feet high and poses a barrier to fish passage. The proposed project would include construction of a bypass structure at the ACDD but would not otherwise alter the ACDD. The proposed bypass structure would not alter the height of the dam and would not alter the existing fish passage conditions at the ACDD. Thus, there would be no change from the existing condition regarding the existing impassable barrier to fish passage at the ACDD.

Impact Conclusion

Construction of the proposed Calaveras Dam replacement and the proposed modifications to the ACDD would have no effect on fish passage at either of these existing passage barriers.

Impact 4.5.4: Temporary effects on fisheries resources related to increases in sediments and turbidity and to release of and exposure to contaminants.

Construction activities would disturb in-stream sediments and soils adjacent to waterways. These activities include replacement of the dam; installation of bypass pipes and valves at the ACDD; construction of haul roads and barge-related facilities, and the use of borrow and disposal sites. Any resulting erosion or disturbance of in-stream and in-reservoir sediments and soils would temporarily increase turbidity and sedimentation downstream of the construction sites throughout the primary study area if soils are transported in creek flows, stormwater runoff, or reservoir water. (See the Impacts subsection in Section 4.7, Water Quality, for additional discussion of this issue.)

All fish species present in waterways downstream of construction activities, including special-status resident rainbow trout and other native and non-native species, could be adversely affected by construction-related impacts on water quality. Fish population levels and survival have been linked to levels of turbidity and silt deposition. Prolonged exposure to high levels of suspended sediment would create a loss of visual capability in fish in the study area aquatic habitats, leading to a reduction in feeding and growth rates; a thickening of the gills, potentially causing the loss of respiratory function; clogging and abrasion of gills; and increases in stress levels, reducing the tolerance of fish to disease and toxicants (Waters 1995). Turbidity also could result in increased water temperature, especially in shallow quiet pools, and in turn affect DO levels, both effects thereby stressing respiration for all fish species present. The impact of increased temperature and reduced DO concentrations related to turbidity in the warm low-flow season would be particularly stressful for over-summering fish, including resident rainbow trout.

High levels of suspended sediments may cause the movement and redistribution of fish populations, and could diminish the character and quality of the physical habitat important to fish survival. Once suspended sediment is deposited, it would reduce water depths in stream pools, decreasing the water's physical carrying capacity for juvenile and adult fish (Waters 1995). The

pools provide important habitat to ensure survival during low-flow periods and are particularly sensitive to impact from sediment. Increased sediment loading would degrade food-producing habitat downstream of construction areas. Sediment loading would interfere with photosynthesis of aquatic flora and displace aquatic fauna. Many fish, including rainbow trout, are sight feeders, and turbid waters reduce the ability of these fish to locate and feed on prey. Some fish, particularly juveniles, likely would become disoriented and leave areas where their main food sources are located, ultimately reducing their growth rates. Prey (e.g., macroinvertebrates) of resident fish populations would be adversely affected by decline in habitat (i.e., water quality conditions) such as increased turbidity, decrease in DO content, increased level of pollutants, or, although unlikely as a project effect, an extreme change in pH or water temperatures. Decreases in the diversity and abundance of smaller organisms living on or in the sediments have been associated with smaller sediment grain sizes and the associated DO decreases in those sediments (Harrington and Born 2000). The potential reduction in the abundance of smaller aquatic organisms that provide an important food source for fish could diminish the overall forage quality for fish and thereby reduce the robustness of individuals, which in turn would affect the health and viability of fish populations and the fish community.

Avoidance of adverse habitat conditions by fish is the most common result of increases in turbidity and sedimentation. Fish will not occupy areas unsuitable for survival unless they have no other option. Some fish will not spawn in excessively turbid water (Bell 1986). Therefore, if high turbidity results from construction activities, some fish species may be precluded from occupying habitat required for specific life stages. In some stream reaches, few opportunities for escape from turbid waters may be available, particularly during the dry season when flows drop and fish over-summer in smaller pools. Due to the large magnitude of construction activities, increased turbidity could result in substantial adverse effects on the special-status resident rainbow trout as well as the larger fish community. This potentially significant impact would be reduced to a less-than-significant level through the implementation of Mitigation Measure 5.7.1, which would require site specific Best Management Practices (BMPs) to be implemented to avoid or minimize water quality impacts from the erosion and transport of sediment, meet Basin Plan water quality objectives, and protect Beneficial Uses. Placement of BMPs would occur before construction activity is initiated at a given site and be maintained throughout construction. The BMPs would include measures such as installing silt fences, directing runoff into constructed settling basins, covering stockpiled soils, and locating stockpiled soils away from drainage areas. Silt fences intercept and detain sediment while decreasing the velocity of sheet flow runoff, allowing particles to settle and preventing them from entering water bodies (CASQA 2003).

Potential construction of barge-related facilities in the reservoir (e.g., possible piles, mooring structures) associated with Haul Route Option 2 (described in Subsection 3.5.1.7, Access and Roads, in Chapter 3, Project Description) would require in-water construction activities. Disturbance from such activities could harass and displace fish present during construction,

including special-status resident rainbow trout; however, these effects would be localized and temporary, and the reservoir would provide substantial area for escape. Construction activities, including construction (and later removal) of docks and operation of barges during construction of the replacement dam, would also result in localized and temporary disturbance of the lakebed sediments and increased turbidity. As the reservoir would not present any obstacle to fish escaping the barge docking sites and there would be sufficient unaffected habitat to which fish could relocate, temporary and localized loss of habitat would not likely result in a substantial loss of important fish species or substantial change in the fish community. Nevertheless, implementation of Mitigation Measure 5.7.1 would address grading and erosion control, barge speeds, solid waste management, hazardous materials handling and storage, and spill prevention and response. Implementation of this measure would ensure that the potential impacts of Haul Route Option 2 on the fish community in Calaveras Reservoir would remain less than significant.

Contaminants such as fuels, oils, other petroleum products, cement, and various chemicals used in construction activities could be introduced accidentally through spills into the water system directly or incrementally through surface runoff from haul routes and construction sites and discharge from barge tugboat motors (see the Impacts subsection in Section 4.7, Water Quality). In sufficient concentrations, these contaminants could be toxic to fish occupying study area habitats or they may alter oxygen diffusion rates and cause acute and chronic toxicity to aquatic organisms, thereby reducing growth and survival. Trash, plastic bags, cans, tape, paper, wrapping material, and other solid wastes also could be deposited in streams and could entrap, injure, or otherwise harm fish and other aquatic life. This would be a potentially significant impact. To reduce the possibility of accidental spills or releases of contaminants, hazardous materials handling, storage, and spill response procedures would be implemented in accordance with Mitigation Measure 5.7.1. The contractor would use appropriate procedures for the proper use, storage, and disposal of materials and equipment on barges, boats, temporary construction pads, or similar locations, which minimize or eliminate the discharge of potential pollutants to a watercourse.

Excavation and placement of material for construction of the new dam, including soil from borrow areas, would result in contamination of fish habitat if the material contains any contaminants or elevated substances that could be toxic to fish. Because the condition of soil in the existing dam is not fully known, there is potential for soil material used in the dam to contain contaminants or hazardous naturally occurring asbestos (NOA) that, in sufficient concentrations, could be harmful to sensitive fish and aquatic species. Little information could be found in preparing this document about the effects of NOA on aquatic organisms, including fish. One study in British Columbia found that elevated chrysotile asbestos fibers introduced in high concentrations by a landslide into a river resulted in elevated manganese and nickel levels in threespine stickleback tissue (Schreier et al. 1987). However, besides the elevated trace metals, no abnormalities were observed in the sampled fish. Based on this single study, the assumption is

that exposure of fish to natural asbestos fibers in the water related to project construction could potentially have adverse effects on their health, but it is not likely to be significant for individuals nor result in a significant adverse impact on fish populations. Additionally, while not required for purposes of fish protection from NOA, implementation of Mitigation Measure 5.7.1 (construction BMPs) would reduce potential impacts on water quality to a less-than-significant level.

Impact Conclusion

Because construction-related sediment discharges and increased turbidity or other contamination could temporarily degrade water quality and reduce or adversely affect fish habitat and fish populations in localized areas, including resident rainbow trout in the primary study area, this would be a significant but mitigable impact. The impact would be reduced with the implementation of proposed construction BMPs and Stormwater Pollution Prevention Plan (SWPPP) measures to minimize sediment and contaminant release and mobilization (see the discussion under Impact 4.7.1 in Section 4.7, Water Quality and Mitigation Measure 5.7.1 in Section 5.7). Because impacts are anticipated to be relatively localized and the extended study area is approximately 9.3 miles downstream of construction activities, impacts in the extended study area are anticipated to be less than significant. Implementation of Mitigation Measure 5.7.1 by the SFPUC would further reduce these impacts to fish and ensure that the impacts remain at a less-than-significant level.

Operational Impacts

Operational impacts include impacts that could result from operation of the proposed project. Project operations were evaluated based on changes in releases from Calaveras Dam, returning to pre-DSOD restricted diversions from the ACDD *but with minimum bypass flows*, and restoring Calaveras Reservoir to full storage levels. Information on operational impacts is presented as operations during the construction period and operations during reservoir filling and normal operations.

Impact 4.5.5: Effects on native fish in Alameda Creek from the ACDD downstream to the confluence with Calaveras Creek.

The approximately 2.9-mile segment of Alameda Creek, downstream of the ACDD to the confluence with Calaveras Creek (Reaches A-3 and A-4) at present provides habitat for spawning and over-summering resident rainbow trout, as well as other native species. Flows during winter months are heavily influenced by rainfall, resulting in a wide variation of flows (sometimes called “flashy”). In the summer months, flows are naturally low and stream habitat is fragmented. Beyond the natural flows in the creek during this period, there is no way to make releases from the ACDD that would support fish habitat in Alameda Creek from the ACDD downstream to the Calaveras Creek confluence (e.g., flows cannot be returned from Calaveras Reservoir via the tunnel to Alameda Creek). During this low-flow summer period, trout and other fish reside

primarily in bedrock pools. Alluvial gravels provide substrate for trout spawning, and the occurrence of multiple age classes of trout within the area indicates that successful reproduction may be taking place (ETJV 2008); however, it is possible that the presence of multiple age classes could be a result of contributions from upstream populations and not necessarily production from within this specific reach. An assessment of the existing fish community indicates that while the reach supports native fish species that would be expected to occur there, trout density is relatively low in comparison to coastal streams in the Central Coast region. This is likely a product of altered hydrology due to diversions and naturally low summer flows and warm water temperatures (ETJV 2008; Sak, pers. com., 2008).

During current operations, the ACDD diverts water from the upper Alameda Creek watershed to Calaveras Reservoir via the Alameda Creek Diversion Tunnel. Flows at the ACDD are diverted into the tunnel up to the maximum capacity of the tunnel, which is estimated at about 650 cfs. Inflow to the ACDD that exceeds the tunnel capacity (or when the tunnel gates are closed) flows over and downstream of the ACDD and continues downstream in Alameda Creek.

As described above in Section 4.5.1, diversions from Alameda Creek to Calaveras Reservoir have been reduced since 2001 because of the DSOD restrictions on Calaveras Reservoir. Currently, Calaveras Reservoir is often filled to approximately the maximum permitted storage level with runoff from its natural drainage and, at these times, has no allowed capacity to accept diversions from Alameda Creek. Therefore, while the DSOD restrictions on Calaveras Dam are in effect, the SFPUC has limited need to capture and divert most local watershed runoff from upper Alameda Creek. The post-2002 flows in Alameda Creek downstream of the ACDD, while extremely variable depending on whether or not diversions were being made, have generally been greater than they were prior to the DSOD restrictions (2002).

Modeling of future operations under the proposed project indicates that diversions at the ACDD to Calaveras Reservoir would primarily occur during the October through April rainy season and the greatest diverted/reduced streamflow quantities would occur from December through March in normal and above-normal years and January of wet years (see Section 4.6, Hydrology). The magnitudes of flows continuing down Alameda Creek past the ACDD during these months would be reduced compared to baseline conditions. However, flows past the ACDD would be increased or remain unchanged from baseline conditions in all other months in all hydrologic year types.

On a storm-by-storm basis, even when streamflows exceed 650 cfs, existing and proposed diversions to Calaveras Dam substantially reduce the flows and alter the hydrograph, leaving only brief periods of high flows in major storm events. Both duration and magnitude of flows in the creek downstream of the ACDD have been reduced during storm events because of the diversion and would continue to be reduced by operation of the proposed project. However, the proposed

project would include flow bypasses consistent with the 1997 MOU whenever those flows are naturally present in upper Alameda Creek.

In summary, implementation of the proposed project would modify the current operation of the ACDD diversion to include more frequent diversions, while bypassing flows consistent with the 1997 MOU. Diversions from Alameda Creek to Calaveras Reservoir during the baseline period, at times, eliminated the low and moderate (1 to 650 cfs) flows in Alameda Creek downstream of the ACDD and did not include any predictable bypass flows for fish species. The proposed project would include minimum bypass flows up to 20 cfs (during spawning periods) provided that water is available. The proposed bypass flows would ensure that the flows in Alameda Creek downstream of the ACDD would either be increased or remain unchanged for purposes of supplying adequate fish spawning habitat for resident rainbow trout.

Under the proposed project (including bypass flows consistent with the 1997 MOU), flows in Alameda Creek in the segment of Alameda Creek between the ACDD and the Calaveras Creek confluence would be changed compared to the conditions in existence since December 2001, when the DSOD imposed storage capacity restrictions on Calaveras Reservoir began to be initiated. Under current baseline conditions, the SFPUC closes the diversion gates and ceases Alameda Creek diversions to Calaveras Reservoir once the reservoir is at desired levels, such that the later season storm flows not needed to refill Calaveras Reservoir are allowed to flow down Alameda Creek past the ACDD. The schedule for making diversions has been variable but generally less frequent compared to pre-DSOD restricted conditions (see Table 4.5.1 and Figure 4.5.3).

Prior to the DSOD restrictions, all inflow up to 650 cfs was diverted during the rainy season even if little water flowed in Alameda Creek past the ACDD. Proposed bypasses at the ACDD would provide a more predictable and stable flow to this reach, at a variably reduced level compared to current DSOD-restricted operations (because diversions are variable and more limited), but at an increased level of flow compared to pre-DSOD conditions. The more predictable and stable flow to this reach would result in beneficial effects on fish habitat, particularly for the sensitive resident rainbow trout and other cold-water aquatic biota. Overall, the average annual amount of flow in wet years would slightly increase, in above-normal and normal years slightly decrease, and in below-normal and dry years substantially increase. Over all years, flows would increase on an average annual basis (see Table 4.6.19).

Impacts During Construction Period Operations

Operation of the ACDD during construction of Calaveras Dam would be similar to that occurring under existing conditions; therefore, there would be no impact on the existing fish community during this period.

Impacts During Filling and Normal Restored Storage Operations

Once construction of the dam is complete and Calaveras Reservoir filling is initiated, the ACDD would be operated to divert water through the diversion tunnel and into the reservoir and bypass flows through the ACDD consistent with the 1997 MOU. Up to 650 cfs could potentially be diverted based on the capacity of the tunnel. During periods when the ACDD diversion is in operation, minimum flows would be bypassed and flows above 650 cfs would spill over the ACDD and supply water for fish habitat downstream. During periods when ACDD diversion is in operation and such flow peaks do not occur, the only water in Reaches A-3 and A-4 would be from bypasses, direct runoff from adjacent slopes, and springs.

Diversions and Bypass Flows

Studies recently completed by Hagar Environmental Sciences and Thomas R. Payne and Associates (ETJV 2008) identified ranges of flows that would be predicted to provide habitat for resident rainbow trout spawning in Alameda Creek. The objective of the assessment was to quantitatively determine the relationship between streamflow and potential spawning habitat for rainbow trout/steelhead. Rainbow trout/steelhead was selected as the evaluation species because (1) it is a highly valued species with a high regulatory profile, (2) there is a substantial amount of technical information on this species to support such an assessment, (3) there is not sufficient technical information on other native fishes to support such an assessment, and (4) many of the other native fishes (e.g., Pacific lamprey and Sacramento sucker) spawn in locations and under conditions that are similar to those selected by rainbow trout/steelhead. The spawning phase of the life history was selected for assessment because the spawning period for many of the native fishes, including rainbow trout/steelhead, occurs during the winter months when operation of the ACDD diversions and Calaveras Reservoir releases would have the largest potential influence on streamflows.

The study determined that flows in Alameda Creek between the ACDD and the Calaveras Creek confluence in the range of 10 to 33 cfs provide the *most* suitable quantity and quality of rainbow trout spawning habitat.⁶ For Alameda Creek downstream of the Calaveras Creek confluence, the studies indicate that flows in the range of 15 to 55 cfs provide the *most* suitable quantity and quality of rainbow trout spawning habitat. The proposed minimum bypass flows at the ACDD (consistent with 1997 MOU flows) range up to 20 cfs during spawning periods and thus are within the range identified for rainbow trout. After spawning, the eggs incubate within the gravel and hatch about 19–80 days later at water temperatures ranging from 15.5°C to 4.5°C, respectively (warmer water temperatures result in shorter incubation times). The average incubation period is approximately 4–6 weeks. After hatching, the young fish (alevins) remain in

⁶ Eighty percent or greater of maximum usable area based on relationship between streamflow and spawning habitat requirements (i.e., water depth, flow velocity, and substrate type and size).

the gravel for an additional 2–6 weeks before emerging from the gravel and taking up residence in the shallow margins of the stream where they feed primarily on insects (Raleigh et al. 1984, ETJV 2008). A suitable base level of flow ranging from 20 cfs to 7 cfs, depending on time period (through the MOU flow schedule), would be bypassed/released for spawning and egg incubation. Together, the spawning flow (20 cfs) and the subsequent rearing flow (7 cfs) associated with the MOU flow schedule would be anticipated to provide suitable hydrologic and interstitial conditions to support spawning, egg incubation, and emergence of alevins. Based on the flow study and spawning and egg incubation habitat requirements, the minimum bypass flows would be expected to provide adequate surface water to maintain spawning and egg incubation habitat functions in Alameda Creek.

Potential water quality impacts from the proposed project operations on the portion of Alameda Creek between the ACDD and the Calaveras Creek confluence are analyzed in Section 4.7, Water Quality. In summary, the overall water temperature in this portion of the creek would be similar to or slightly lower than existing conditions. DO and nutrient levels in the creek are not expected to change measurably from existing conditions. Regarding settleable materials, suspended materials, and turbidity, it is expected that future operations would result in slightly higher sediment loads in Alameda Creek during dry years, and from March to June of all other years, because of bypass flows from the ACDD. However, these releases are expected to contribute only minimally to overall suspended sediment load and turbidity within the creek and be similar to natural background conditions upstream of the ACDD. The project is expected to have a less-than-significant impact on water quality within Alameda Creek with respect to all water quality parameters. The bypass flows would occur whenever streamflow is naturally present and therefore would provide more stable and reliable habitat compared to the existing condition, which includes variable periods of full diversion of flow with no bypasses. Therefore, the proposed ACDD diversion would be expected to have a less-than-significant impact on fish and fish habitat downstream of the diversion.

Although the proposed bypass flows are expected to be adequate to sustain the resident trout population downstream of the ACDD, monitoring and adaptive management required under Mitigation Measures 5.5.5a and 5.5.5b would further ensure that future operations of the ACDD will not have a significant impact on the resident trout population in Alameda Creek. Pursuant to Mitigation Measure 5.5.5a: Resident Rainbow Trout Monitoring, the SFPUC will monitor the effects of operation of the CDRP on resident trout in Alameda Creek downstream of the ACDD. If monitoring demonstrates that the MOU flow bypasses are not adequate to sustain the resident trout fishery downstream of the ACDD, the SFPUC will implement Mitigation Measure 5.5.5b: Resident Rainbow Trout Adaptive Management. Under Mitigation Measure 5.5.5b, the SFPUC would be required to modify the flow release schedule, implement seasonal restrictions on Alameda Creek diversions during the spawning period, or install a fish screen at the diversion tunnel. Therefore, with the implementation of the MOU flow bypasses under the proposed

project and the monitoring and adaptive management requirements under Mitigation Measures 5.5.5a and 5.5.5b, the impacts of operation of the CDRP on resident trout in Alameda Creek would be less than significant.

In the summer season, under existing operations, SFPUC closes the gate to the ACDD so that minimal natural flow is not diverted. This practice allows adequate flows to support oversummering of resident trout in Alameda Creek between the ACDD and the confluence with Calaveras Creek. The proposed project would continue the practice of bypassing summer flows; therefore, the proposed project would have no impact on fish and fish habitat in this reach of Alameda Creek during the summer compared to existing conditions.

Channel-Forming Flows

Project-related diversions and bypasses at the ACDD would also alter the frequency and magnitude of channel-forming flows that support geomorphic processes within the creek. However, project-related operation of the ACDD would result in downstream hydrologic conditions consistent with those that have influenced the form and maintained the channel over the longer period of pre-DSOD operation, which included periodic intermediate and episodic flow events well above the 650-cfs capacity of the tunnel that flowed over the ACDD and downstream. For example, Figure 4.5.3 shows periods in early 2003, 2004, and 2008 where peak flows greatly exceeded the 650 cfs capacity of the diversion tunnel. In the future with the project, such flows would continue to occur, as shown in Figures 4.6.14a and 4.6.14b. Further, the baseline period of DSOD-regulated operations and associated variable operation of full diversions with no bypasses (see Figure 4.5.3) is likely too short and too variable to have had a changed effect on channel form. Therefore, future operations of the CDRP would have a less-than-significant effect on channel-forming flows in the reach of Alameda Creek between the ACDD and the Calaveras Creek confluence. Additional discussion on project-related effects on channel-forming flows and sediment transport and deposition processes is provided in Section 4.6 under Impact 4.6.10: Effects on channel formation and sediment transport along Alameda Creek downstream of the ACDD to the Calaveras Creek confluence.

Sediment Sluicing

Annual releases of sediment from the ACDD sluice gate under the proposed project would be similar to those under existing conditions. The amount of sediment sluiced each year could be reduced, however, because increased diversion of flows compared to certain periods during the DSOD restrictions would result in increased diversion of sediments (entrained in the water) to Calaveras Reservoir. The proposed diversion of flows from the ACDD would take relatively less of the high flows in wet years and relatively more of the high flows in above-normal and normal years. Because high flows have the ability to transport the greatest amount of sediment (see discussion of sediment transport in Section 4.6, Hydrology), the proposed diversion of flows from

the ACDD would maintain the potential to transport large volumes of sediment in large storm events. Proposed sluicing flows would occur in all years and would result in sediment transport and distribution in Alameda Creek similar to baseline conditions. The magnitude and associated implications of this effect would be similar to the effects that persisted during the years prior to the DSOD-restricted operations and during those periods under DSOD restriction when diversion was not taking place and generally contributed to the current habitat conditions. The transport of remaining sediment through the diversion dam would continue to maintain geomorphic processes, including gravel recruitment to habitats downstream. Because this effect would be similar to what has occurred under existing conditions and effectively the same as what occurred prior to DSOD-restricted conditions, sluicing of sediments would have a less-than-significant impact on fish habitat.

Redd Scour and Erosion

During periods of peak flows, the diversion of up to about 650 cfs at the diversion dam could provide a benefit to native fish by reducing the likelihood that eggs incubating in redds downstream of the diversion dam would be vulnerable to scour and erosion, which is an existing vulnerability given the essentially free flow of the creek over the ACDD during times when diversions were not being made. As such, the more regular diversions and consistent bypass flows whenever flows are naturally present would be expected to contribute to improved reproductive success of those fish spawning within the reach, provided that a suitable base level of flow is still naturally present for spawning and egg incubation (ETJV 2008). More uniform base flow with shorter and lower magnitude peak flows during trout spawning would be a beneficial effect due to reduced potential for scouring and dewatering of redds and reduced juvenile salmonid stranding and isolation as compared to the variable operations under the existing condition.

Fish Entrainment at the Diversion Tunnel

Under existing conditions, resident rainbow trout are most abundant in Alameda Creek upstream of the ACDD, but also occur downstream in the reach between the ACDD and the confluence of Calaveras Creek where habitat conditions are more limited during dry and warm summer months. An unknown number of rainbow trout and California roach in Alameda Creek upstream of the ACDD are likely washed over the ACDD and/or are entrained in the diversion tunnel to Calaveras Reservoir (during periods when diversions are being made) during high-flow conditions. It is not known how many fish enter the area immediately upstream of the ACDD during high-flow conditions and subsequently go over the ACDD and/or become entrained into the diversion tunnel. Logic dictates that this would partly depend on the size of populations upstream of the ACDD (and for juvenile trout, possibly the location of spawning habitat relative to the ACDD); the magnitude and rate of diversion, the timing, duration, and magnitude of high-flow events and the behavioral characteristics of the fish that are vulnerable to entrainment.

Diversion Magnitude and Rate of Diversion: The relationship between fish entrained in unscreened diversions and the amount of water diverted is poorly understood (Moyle and Israel 2005). Past studies on potential entrainment rates of anadromous steelhead and salmon at diversions (summarized in Moyle and Israel 2005; Hanson 2001) suggest that the relationship between the amount of water diverted and the number of fish entrained, while generally positive at higher levels of diversion, was relatively small (rate of diversion), was determined to be fairly complex, and has high seasonal and year-to-year variation.

The studies presented were on large low-gradient rivers primarily evaluated juvenile anadromous fish, which generally exhibit a migrant behavior and therefore exposed themselves to the diversion during migrations downstream. Conversely, resident rainbow trout are site-attached for much of their life cycle. The surface water habitat just upstream of the ACDD dries up during summer months and is generally not suitable adult holding habitat. Based on site fidelity of adult trout, it is likely that adult trout would not be holding near the ACDD or be migrating downstream; therefore, they would not be likely to enter the area immediately upstream of the ACDD where they could get entrained in the diversion (Moyle pers. com., 2009). Also, adult trout would be less likely to be washed over the ACDD structure because during high flows they would simply find velocity refugia near their preferred habitat area (Moyle pers. com., 2009). Young-of-year trout would be more likely to be washed downstream or potentially migrate downstream towards the ACDD. Younger trout seeking new territory or those that have been “pushed out” of habitat upstream would more likely be washed downstream and over the ACDD during high-flow events, although numbers would be expected to be relatively low (Moyle pers. com., 2009). Young-of-year trout in the wild can typically have a 90-percent mortality rate; thus the loss of a small amount of young-of-year trout may not be important to the maintenance of the population (Moyle pers. com., 2009). The key is to maintain the adult trout population, and a size and age structure that maintains a self-sustaining population. Based on limited monitoring data, it appears that the isolated trout population upstream of the ACDD is self-sustaining even with the presence of the unscreened diversion. Further, the more limited diversions (in frequency and duration) at the ACDD and diversion tunnel during DSOD restrictions have only been implemented from 2001/2002 to the present, whereas, the diversions that occurred during the approximate 70-year period prior to DSOD restrictions were likely more similar in frequency and duration to what is anticipated with the proposed CDRP.

Injury and/or Mortality: While there are no studies tracking the fate of trout (or other species) that become entrained in the diversion tunnel, it is reasonable to that some level of injury and mortality occurs. Once entrained, fish would be conveyed through the approximate 1.5-mile tunnel and drop approximately 35 feet over the concrete tunnel spillway outlet structures into Calaveras Reservoir. In the reservoir, water quality conditions may be different from those in upper Alameda Creek, with potentially varying levels of suitability. These conditions would result in increased stress at the very least, and potentially mortality at some unknown level. As

described above, the likelihood of adult trout becoming entrained in the diversion is low, while young-of-year trout would have a higher likelihood of becoming entrained in the diversion. Some portion of young-of-year trout would likely end up as prey for larger warm-water fish in the reservoir. Thus, survival probability of entrained fish is estimated to be low.

Similar to the diversion tunnel, some level of mortality could be expected for fish that are conveyed over or through (via bypasses) the 31-foot-high ACDD. Due to the shorter route for fish that are washed over or through the ACDD, there could be a higher likelihood of survival compared to trout entrained in the long diversion tunnel and high drop off from the outlet into Calaveras Reservoir. Trout that are washed over the ACDD would be carried over during high-flow events, which may help reduce injury compared to fish experiencing entrainment into the diversion tunnel. Further, trout would remain in the same ambient water temperatures and water quality conditions, thus reducing the potential for stress and mortality (as compared to the potential at Calaveras Reservoir). While entrainment in diversions or over/through the ACDD may be a factor in fish mortality, the limiting factor for trout downstream of the ACDD under existing conditions is summer rearing habitat. Summer rearing habitat is marginal and likely is the primary reason trout numbers are low downstream of the ACDD. Under future conditions, summer rearing habitat would be improved downstream of the Calaveras Creek confluence (due to the CDRP's proposed bypass flows and releases from Calaveras Dam; see additional information below) and survival of trout in reaches downstream of the Alameda and Calaveras Creek confluence would be greater than has occurred under the existing condition as well as during the period prior to DSOD-restricted conditions.

Effects of Entrainment on Fish Populations Downstream and Upstream of the ACDD: Surviving fish entrained in the diversion tunnel would effectively be removed (i.e., isolated) from contributing further to the population of trout in Alameda Creek. Fish entrained in the diversion could contribute to the population in Calaveras Reservoir if they survived. However, it is likely that the trout that would be entrained would be young-of-year trout and would simply become prey for larger warm-water species in the reservoir. Further, it is believed that only a relatively small number of fish would actually be entrained in the diversion tunnel (Moyle pers. com., 2009). Surviving fish conveyed over or through the ACDD have a low potential for survival over summer months because habitat downstream of the ACDD is seasonally marginal under current conditions (i.e., habitat for rearing is currently limited). Limited rearing habitat has likely kept the trout population extremely low (as documented by annual SFPUC monitoring) in reaches downstream of the ACDD. Thus, under existing conditions, the trout population upstream of the ACDD has limited value as a “source population.” Under future conditions, with proposed bypasses and releases from Calaveras Reservoir, rearing conditions will improve. Thus, young fish that are washed over the ACDD under future conditions will have a higher likelihood of survival. The value of the population upstream of the ACDD as a source population will increase under future conditions due to the

proposed releases from Calaveras Reservoir, which will improve summer rearing habitat conditions and increase survival of trout downstream of the Calaveras Creek confluence; however, the source population value is expected to remain low due to the relatively low numbers of fish that would be anticipated to move from upstream of the ACDD downstream (Moyle pers. com., 2009).

Summary: More regular diversions at the ACDD could result in more fish becoming entrained in the diversion tunnel; however, numbers of entrained fish would be expected to be relatively low due to their anticipated general behavioral characteristics (Moyle pers. com., 2009) and of what is believed to be a relative small and isolated population of resident rainbow trout upstream of the ACDD. Rainbow trout and California roach populations upstream of the ACDD have sustained themselves over the past approximately 70 years of regular diversions at the ACDD. As a result, returning to operations with regular diversions at the ACDD is not anticipated to result in a substantial adverse effect on those populations. Further, rainbow trout and California roach upstream of the ACDD are not anticipated to be an important “source population” for downstream reaches of upper Alameda Creek due to the small isolated nature of that population and the relatively small numbers of individuals that would be expected to move downstream into the area of the ACDD (Moyle pers. com., 2009). Therefore, effects of operation of the ACDD on fish entrainment and the consequent loss of individuals in the upstream fish population are expected to be less than significant.

Although entrainment impact on resident rainbow trout in Alameda Creek are expected to be less than significant, monitoring and adaptive management required under Mitigation Measures 5.5.5a and 5.5.5b would further ensure that future operations of the ACDD will sustain the resident trout population downstream of the ACDD. Pursuant to Mitigation Measure 5.5.5a Resident Rainbow Trout Monitoring, the SFPUC will monitor the effects of operation of the CDRP on resident trout in Alameda Creek downstream of the ACDD. If monitoring demonstrates that the MOU flow bypasses are not adequate to sustain the resident trout fishery downstream of the ACDD, the SFPUC will implement Mitigation Measure 5.5.5b Resident Rainbow Trout Adaptive Management. Under Mitigation Measure 5.5.5b, the SFPUC would be required to modify the flow release schedule, implement seasonal restrictions on Alameda Creek diversions during the spawning period, or install a fish screen at the diversion tunnel. Therefore, with the implementation of the MOU flow bypasses under the proposed project and the monitoring and adaptive management requirements under Mitigation Measures 5.5.5a and 5.5.5b, the impacts of operation of the CDRP on resident trout in Alameda Creek would be less than significant.

Impact Conclusion

Increases in the frequency and duration of diversion of flows up to 650 cfs combined with flow bypasses consistent with the 1997 MOU whenever naturally present would result in more stable

and reliable habitat conditions in Alameda Creek downstream of the ACDD when compared to the variable periods of no diversions and full diversions without bypass flows under the DSOD-restricted existing condition. Proposed bypass flows conforming to the MOU would ameliorate effects on habitat caused by increased diversion frequency and duration and, as far as predictive models indicate, would ensure that fish habitat is maintained in such a manner as to ensure a viable fish community downstream of the ACDD. Higher magnitude channel maintenance flows would be reduced in frequency and magnitude; however, these flow events would return to levels similar to those that influenced the form of the creek over the past 70 years and sluicing of sediment would remain similar to that under the existing condition. Fish entrainment in the diversion tunnel could increase due to increased diversions; however, any increases in entrainment would be anticipated to be small and would not be expected to result in adverse effects on fish populations in Alameda Creek upstream or downstream of the ACDD, which have sustained themselves over 70 years of regular diversions. The overall effect on fisheries resources along Alameda Creek would be a less-than-significant impact.

Based on available information and the analysis provided above, implementation of the MOU bypass flows as proposed under the CDRP is expected to ensure that future operation of the CDRP on resident trout in Alameda Creek would be less than significant. However, pursuant to Mitigation Measure 5.5.5a Resident Rainbow Trout Monitoring, the SFPUC will monitor the effects of operation of the CDRP on resident trout in Alameda Creek downstream of the ACDD. If monitoring demonstrates that the MOU flow bypasses are not adequate to sustain the resident trout fishery downstream of the ACDD, the SFPUC will implement Mitigation Measure 5.5.5b Resident Rainbow Trout Adaptive Management. Under Mitigation Measure 5.5.5b, the SFPUC would be required to modify the flow release schedule, implement seasonal restrictions on Alameda Creek diversions during the spawning period, or install a fish screen at the diversion tunnel. Therefore, with the implementation of the MOU flow bypasses under the proposed project and the monitoring and adaptive management requirements under Mitigation Measures 5.5.5a and 5.5.5b, the impacts of operation of the CDRP on resident trout in Alameda Creek would be less than significant.

Impact 4.5.6: Effects on native fish in Calaveras Creek below Calaveras Dam and in Alameda Creek downstream of the confluence with Calaveras Creek in the primary study area.

Project-related operation of Calaveras Dam and the ACDD could affect the quality and quantity of important habitat for the fish community and/or prey species downstream in Calaveras Creek and Alameda Creek. Water releases from Calaveras Dam and bypasses from the ACDD directly influence habitat conditions downstream in Calaveras and Alameda Creeks through flow/habitat relationships and influence important geomorphic processes needed to maintain aquatic habitats for aquatic organisms. Adequate base flows are necessary for basic aquatic habitat function, and rapid increases or decreases in flow can change the location and quality of fish habitat. Periodic

intermediate and high flushing flows are important to geomorphic function because they remove fine sediments from coarse substrates, clear away encroaching vegetation, recruit gravel for salmonid and lamprey spawning substrate, contribute to the recruitment and deposition of in-stream woody material, and maintain deep pool habitat. Calaveras Creek and Alameda Creek downstream of Calaveras Dam and the ACDD at present exhibit channels that have been formed by highly altered hydrologic conditions over about nine decades since Calaveras Dam was built and natural flows were modified. Based on available records, Calaveras Reservoir spilled in 13 years since 1938 (see Table 4.6.11: Pre-DSOD Restriction Calaveras Reservoir Spillway Releases) with an average daily spill rate for the period of record of 399 cfs (range from 31 to 634 cfs). These spills, in combination with storm runoff that typically occurred in the same periods as reservoir spills, resulted in high flows that likely were the primary contributors to channel forming and maintenance of post-dam geomorphic processes downstream in Calaveras and Alameda Creeks. Additionally, annual pulse-flow releases associated with water evacuations and required cone valve testing have provided flows ranging from approximately 130 to approximately 870 cfs (depending on reservoir level), which also likely contributed to maintenance of these geomorphic processes. (Additional discussion on project-related effects on channel-forming flows and sediment transport and deposition processes is provided in Section 4.6 under Impact 4.6.9: Effects on channel formation and sediment transport along Calaveras Creek.)

Based on the results of recent surveys conducted by the SFPUC in Calaveras and Alameda Creeks (see Table 4.5.3), an assessment of the existing fish community was conducted (ETJV 2008, pp. 33-35) with reference to criteria developed by Moyle et al. (1998) (see Subsection 4.5.1, Setting). The assessment indicated that the existing hydrologic conditions appear to sustain aquatic habitat in a manner that supports a native fish community, which includes resident rainbow trout, in good condition.

The total flow at the confluence of Alameda and Calaveras Creeks is the combination of total seepage, releases, and spills from Calaveras Dam and the ACDD and the unregulated runoff occurring between the confluence and the ACDD and Calaveras Dam. Under existing conditions, flow releases are not made from Calaveras Dam except to evacuate water from the reservoir for purposes of maintaining reduced water elevations consistent with DSOD restrictions and to test that the large cone valve is functioning in accordance with DSOD requirements. As discussed above in Subsection 4.5.1, Setting, water evacuations made through the cone valve have occurred three times since DSOD restrictions have been in effect. Flow rates during these water evacuations ranged from an average of 336 cfs to 375 cfs. At all other times when cone valve releases are not being made, Calaveras Creek hydrology downstream of the Calaveras Dam is maintained primarily through base flows that are associated with subsurface dam seepage, estimated to be approximately 0.5 to 1.0 cfs (CDFG 1997, p. 7). Because most of the flows from Arroyo Hondo and Calaveras Creek are retained in Calaveras Reservoir for water supply storage,

the vast majority of flows in Alameda Creek downstream of the confluence originate in upper Alameda Creek upstream of the ACDD (except when Calaveras Reservoir makes large releases).

Impacts During Construction Period Operations

During construction of the dam, the flow release schedule would not change substantially compared to existing conditions, and the conditions that exist at present would be expected to continue, except as diminished by impairment of water quality (see Impact 4.4.2 in Section 4.4, Vegetation and Wildlife) and two planned shutdown periods when the outlet works would not be functional. Water evacuations would be made through the cone valve (as necessary) to maintain water surface elevations consistent with DSOD requirements. Unless annual precipitation during the construction period were to be substantially greater or have more frequent periods of intense rainfall than under existing conditions, high releases from the large cone valve would be expected to occur at about the same frequency and magnitude as have occurred since DSOD restrictions were placed on the reservoir. Annual cone valve testing would also continue to occur as necessary. As discussed in Subsection 3.5.6, Operation of the Reservoir During Construction, in Chapter 3, Project Description, there would be two shutdowns of the outlet works during construction (mid-April to mid-November in 2011 and 2012 or 2012 and 2013) to allow excavation of the dam foundation and extension of the outlet conduit, and to connect the new intake shaft to the outlet conduit. These shutdowns would be scheduled to maintain an operational outlet during the rainy season (approximately mid-October to mid-April). Water temperature and water quality in releases from Calaveras Reservoir would also be similar to that occurring under existing conditions as the reservoir level would be maintained as it is currently under DSOD restrictions.

Operation during the construction period would not differ substantially from existing conditions (as noted above). During the construction period, flow releases from Calaveras Dam would be managed in a way that is similar to existing conditions except during the two operational mid-April to mid-November shutdowns in 2011 and 2012 or 2012 and 2013, described above. During the shutdowns, all releases would be suspended and all flow in Calaveras Creek downstream of the dam would come from Calaveras Dam seepage; flows in Alameda Creek would be determined by whatever flows remain coming over the ACDD and as seepage, as no diversion into Calaveras Reservoir would occur during the shutdown periods. Under existing conditions, no flow is released from Calaveras Dam to Calaveras Creek except during infrequent cone valve releases, which have generally occurred during brief periods in the winter and spring (see Subsection 4.5.1, Setting). During periods when no releases have been made, typically in the dry season, seepage from under the dam provides base flow hydrologic conditions to support the fish community. These base flows would continue during the construction period and would provide hydrologic conditions that sustain the fish community. Therefore, there would be no significant impact of reservoir operations on the existing fish community during this period.

Additionally, the large cone valve releases at Calaveras Dam (during times outside of the shutdown period) would continue to provide intermediate to high channel-forming flow pulses to Calaveras and Alameda Creeks similar in magnitude to those that have occurred since DSOD restrictions have been in place; therefore, any potential impacts on geomorphic processes affecting fish habitat during construction would be less than significant.

As discussed above, operation of the ACDD during construction would be similar to the existing condition with limited diversions due to the reduced volume in Calaveras Reservoir. During times when diversions are not being made, flows essentially would continue to flow over the ACDD as under the existing condition (see also Impact 4.5.5 above). Thus, operation of the ACDD during construction would have a less-than-significant impact on fish habitat.

In summary, reservoir operations during construction would result in habitat conditions in Calaveras Creek downstream of the dam and Alameda Creek from the confluence of Calaveras Creek downstream to the extended study area similar to the existing condition. Hydrology in Calaveras Creek would be provided by seepage from under the dam and periodic releases from the cone valve, and hydrology in Alameda Creek would be provided by flow over the ACDD and seepage with periodic diversions to the reservoir through the diversion tunnel. This impact would be less than significant. Project operations during construction would have a less-than-significant impact on native fish in Calaveras Creek downstream of Calaveras Dam and in Alameda Creek downstream of the confluence with Calaveras Creek in the primary study area.

Impacts During Filling and Normal Restored Storage Operations

Once construction of the dam is complete, filling of the reservoir and long-term operation would reestablish the diversion of most flows in Alameda Creek to the reservoir. However, the operation would not return to that of pre-DSOD operating restriction conditions. Instead, the 1997 MOU bypasses/releases would be initiated after completion of the construction and continued in perpetuity. The 1997 MOU identifies flow regimes specifically for purposes of improving native fisheries, including rainbow trout in Alameda Creek. This flow release schedule would provide reliable and stable flow bypasses at the ACDD when flows are naturally present and releases from Calaveras Dam during all other times, including summer months. This change in flow conditions would result in improved habitat in the affected reaches of Alameda Creek compared to existing conditions because (1) current operations result in only periodic full bypasses of water at the ACDD when the diversion is closed and concentrated, (2) uniform water evacuation currently releases from Calaveras Dam over relatively short periods of time (2 to 3 months per year), and (3) there are no current flow provisions for management of the downstream fishery.

Table 4.6.20, Estimated Average Monthly Flow in Alameda Creek Downstream of Calaveras Creek Confluence, Figure 4.6.15a, Modeled Flow in Alameda Creek Downstream of the

Calaveras Creek Confluence (1920-1959), and Figure 4.6.15b, Modeled Flow in Alameda Creek Downstream of the Calaveras Creek Confluence (1960-2002), present modeled flow data for Alameda Creek downstream of the Calaveras Creek confluence in terms of the monthly average flow within year type (e.g., wet, above-normal, dry). As shown in the table and figures, there would be reductions of up to 39, 47, and 28 percent in wintertime flow at the confluence during normal, above-normal, and wet years, respectively. As with the upstream reach, peak flows in Alameda Creek would also be substantially reduced in drier years, primarily as a result of renewed upstream diversions at the ACDD. However, as shown in the table, overall flows at the confluence would increase in the future with implementation of the 1997 MOU made through bypasses at the ACDD and/or releases from Calaveras Reservoir. Overall, these changes would result in more reliable and stable rearing habitat conditions compared to the baseline condition.

The MOU flow releases could be made through bypasses at the ACDD when flow and water temperatures are adequate to meet MOU criteria and/or through the two low-flow valves that would be installed at the proposed replacement Calaveras Dam. The implementation of the 1997 MOU flows with the proposed project would have a beneficial impact on native fish and aquatic habitat in Alameda Creek downstream of the ACDD as well as downstream of the confluence with Calaveras Creek.

During the rainy season when the 1997 MOU flows would be provided through bypass at the ACDD, flow in the 0.6-mile segment of Calaveras Creek between the dam and the confluence (Reach C-1) would be maintained through the proposed 2 cfs minimum flow release from Calaveras Dam and inflow from runoff. The potential for MOU flow requirements to be met by Alameda Creek water would be highest during the winter season when flows and cold-water temperatures would be available for bypass at the ACDD. The proposed 2 cfs minimum flow release from Calaveras Dam combined with the seepage flows that would occur with the replacement dam would be expected to provide improved aquatic habitat conditions in Calaveras Creek compared to that under existing conditions. Additionally, releases from Calaveras Dam would be required during summer months to meet MOU flow and temperature criteria, and rains and local runoff would periodically augment the proposed 2 cfs minimum flow releases during winter months when ACDD bypasses would be available. Long-term project operation would have a less-than-significant impact on fish habitat in this section of Calaveras Creek because (1) reduced flow conditions in Calaveras Creek would occur only during the winter months, when seasonal rains and local runoff would contribute to flows; (2) aquatic habitat conditions in this short section of creek are marginal for fish; and (3) only species that are common to the watershed are present, with no resident rainbow trout.

An additional benefit to fish from the proposed project would result from the increased reservoir water volume once the dam construction is complete and the reservoir has been filled. The increased reservoir volume would result in an increased cold-water pool and improved water

quality that would become available for releases. Increased availability of cold water and improved water quality would benefit fish, especially rainbow trout, occupying habitats downstream of the new dam.

Required cone valve testing would continue as necessary, resulting in periodic pulse flows that would provide hydrologic conditions that contribute to the maintenance of geomorphic processes in Calaveras Creek and downstream in Alameda Creek downstream of the confluence.

Additionally, once the reservoir has been filled, it is assumed that periodic spill events would resume. Whereas under existing conditions no spill events have occurred, under future operations such events would occur at a similar or slightly increased frequency, duration, and magnitude compared to those that occurred during pre-DSOD restrictions. Intermediate to high channel-forming flow conditions resulting from cone valve releases (including testing), reservoir spills, and Alameda Creek flows are expected to be similar to those that have influenced the channels over the 70+ years preceding the DSOD storage restrictions. Therefore, the impact on geomorphic processes as they relate to the quality and maintenance of fisheries habitat would be less than significant.

Rapid or sudden increases and/or decreases in flow releases (associated with operation of the cone valve) from Calaveras Dam could result in fish isolation and stranding along the margin of streams if substantial changes in releases were to occur during rainbow trout juvenile rearing periods (March through November/December). High flows that result from spills would exhibit a more gradual increase and decrease because these flow events would be effectively connected with the natural hydrograph. Scouring or dewatering of redds associated with rapid or sudden increases and/or decreases in flow releases could occur if substantial changes in the releases were to occur during rainbow trout spawning periods (January through March). Potential isolation and stranding and/or wash-out or dewatering of redds could affect native fish species occupying habitats downstream of the dam. Stranded fish, particularly juveniles, would be exposed to predators and increasing water temperatures, poor water quality, or the drying out of these areas; with no means to return to the wetted portion of the channel, they would inevitably die unless flow levels increased to the point where the isolated pools were reconnected with the main channel. Redds that become scoured or dewatered would be exposed to many of the same adverse conditions. While the 1997 MOU provides a flow release ramping schedule for Alameda Creek below Calaveras Dam, it is limited to the periods of January 12 to January 15 and March 15 to April 5 and includes only a relative low-flow scenario (i.e., 5 to 20 cfs). It is possible that rapid or sudden increases or decreases in flow releases associated with cone valve releases could occur at a higher flow rate than that specified in the MOU; sudden increases or decreases in these flow releases could result in fish isolation and stranding or scour or dewatering of redds, which could substantially impede the use of spawning habitat and cause a native fish population to drop below self-sustaining levels. This potential effect occurs now under the existing condition during periods when water is released from the cone valve. In accordance with the proposed operational

plan for the CDRP, required testing of the cone valve would be conducted during the least sensitive periods to the extent feasible (September through November except when emergency operation or testing are necessary). Further, the plan would include the development and implementation of flow release ramping criteria for Calaveras Dam for a full range of potential flows that could be released from the low flow and cone valves. The ramping criteria would be applied only to planned (non-emergency) releases and would prescribe rates and timing of both increases and decrease in releases to Calaveras and Alameda Creeks to minimize stranding native fish and amphibian species and/or dewatering of redds. Therefore, the impacts on native fish resulting from operation of the cone valve would be less than significant.

Impact Conclusion

Implementation of the bypasses at the ACDD and minimum releases from Calaveras Dam consistent with the 1997 MOU would provide more stable and reliable habitat conditions for fish in Calaveras Creek downstream of the dam and Alameda Creek between the confluence with Calaveras Creek and the extended study area. This change would result in a beneficial impact when compared to the existing condition. Rapid or sudden increases and/or decreases in emergency flow releases from the Calaveras Dam cone valve could result in fish isolation and stranding along the margin of streams and/or scour or dewatering of redds if the releases are substantially changed during rainbow trout spawning periods; however, the project would not result in a substantial change compared to the flow releases that occur with existing conditions. The project would therefore have a less-than-significant impact.

Impact 4.5.7: Effects of project operations on fish habitat in Calaveras Reservoir and in streams upstream of the replacement dam.

Construction of the replacement dam would take approximately 4 years to complete. During this period, Calaveras Reservoir level would be managed similar to existing conditions as required by the 1991 CDFG MOU (690 feet minimum elevation) (SFPUC 1991) and DSOD restrictions (705 feet maximum elevation). The water quality conditions in the reservoir created by the low water levels are not ideal for some fish species, and it is necessary to operate a hypolimnetic oxygenation system (HOS) to improve them. Once construction of the dam is complete, the reservoir would be filled and operated in a manner that is similar to pre-DSOD restrictions, with a maximum water elevation of approximately 756 feet elevation (i.e., spillway elevation). The HOS system would continue to be operated during the construction period, during filling of the reservoir, and after the reservoir has been filled to maintain DO concentrations similar to those under existing conditions. Once the reservoir is filled, the increased volume of water would result in a greater cold-water pool volume than under current DSOD-restricted conditions.

Impacts During Construction Period Operations

During construction, hydrologic connectivity and fish passage between the reservoir and Arroyo Hondo are limited due to low water elevation, sediment wedge, and lack of a defined channel in the drawdown zone. While the adverse impacts on the fish passage created by this disconnection of Arroyo Hondo and the reservoir can be inferred, there are no data that confirm that the lack of hydraulic connectivity has affected or would significantly adversely affect trout or other fish populations in either the reservoir or Arroyo Hondo.

During project construction, no change from the existing condition would occur (i.e., project-related operation reservoir surface elevations would not change the extent to which the drawdown condition creates fish passage limitations), and thus construction of the proposed project would have no impact on hydrologic connectivity and fish passage between the reservoir and Arroyo Hondo.

Impacts During Filling and Normal Restored Storage Operations

Once construction of the dam is complete, the reservoir would be filled to a maximum water elevation of approximately 756 feet, resulting in a substantially greater pool volume than under current DSOD-restricted conditions. This increased pool volume would result in an increased amount of cold water and improved water quality conditions in the reservoir, which would benefit fish species within the reservoir and downstream in Calaveras and Alameda Creeks (through releases). Additionally, the reservoir would be kept higher for a longer period, thereby sustaining the beneficial habitat conditions for fish. The increased cold-water volume would also support full implementation of releases consistent with the 1997 MOU between SFPUC and CDFG as the MOU relies on sufficient cold water to provide cool flows downstream through the summer.

The increase in pool elevation would also result in the conversion of near-shore tributary stream habitat on Arroyo Hondo to lake habitat (due to inundation). The approximately 9,420 linear feet of Arroyo Hondo in the exposed drawdown zone lack riparian vegetation and a defined channel and exhibit shallow riffles (sediment wedge) that could limit fish movement. As a consequence, this portion of Arroyo Hondo currently provides limited habitat value to fish species (ETJV 2008). The increase in reservoir elevation under the proposed project would provide improved hydrologic connectivity between the reservoir and Arroyo Hondo, which would result in improved conditions for fish migration. These effects would be beneficial, and mitigation would not be necessary.

Calaveras Creek Reach C-2 would not be affected by inundation because the lowermost segment lacks a defined channel and hydrologic connectivity.

The proposed project includes the same fish screens over the top two adits as currently exist under the existing condition. Fish mortality through entrainment in outlet structures is not anticipated to increase from existing conditions because the proposed project includes the same fish screens over the top two adits and the restored reservoir elevation could allow the top two screens to function more effectively per original designs. Operation of the CDRP would therefore have a less-than-significant impact on fish in the reservoir due to entrainment in the adits and restoring the full pool in Calaveras Reservoir would have a beneficial impact as compared to the existing condition.

Impact Conclusion

The effects of the proposed operation of Calaveras Reservoir on fisheries habitat within the reservoir and upstream in Calaveras Creek and Arroyo Hondo would be beneficial.

Impact 4.5.8: Effects of project operations on native fish in Alameda Creek in the extended study area.

As discussed in Subsection 4.5.1, Setting, the extended study area includes the Niles Canyon and lower Alameda Creek reaches. Habitat conditions in both reaches have been heavily modified and altered as a result of past human activities, which have included use of the creek as a conveyance facility for water supply, construction of levees and maintenance of the channel for flood control, aggregate mining, adjacent urbanization, and diking, channelization, and pond construction for commercial salt production. Water supply, erosion control, and flood control structures were constructed in the channel; these structures include the BART weir and PG&E gas pipeline drop structure, and a series of inflatable dams for water supply impoundment (including capture of flows imported from the Sacramento-San Joaquin Delta via the South Bay Aqueduct), local aquifer recharge, and diversion. These features prevent fish migration and impair other habitat functions and would be expected to continue to do so for an undefined time. The BART weir presents a complete barrier to all migrating anadromous fish species, including steelhead, with the possible exception of Pacific lamprey (Gunther et al. 2000, p. 15). The lower, middle, and upper ACWD inflatable dams are also major migration obstacles/barriers in lower Alameda Creek.

Aquatic habitat conditions in lower Alameda Creek are characterized by variable summer flows, high summer water temperature, substrate with a large silt component, extensive stands of emergent vegetation, and tidal mixing with increased salinity in the lower sections near the Bay and freshwater flows in the higher lying reaches upstream of the BART weir. Some sections may be dry during the summer (Hanson Environmental Inc. 2002). Aquatic habitat conditions for steelhead downstream of the BART weir (upstream extent of passage) do not currently support spawning functions and only provide very limited rearing values.

As discussed in Section 4.6 (see Impact 4.6.7: Operational effects on flow in Alameda Creek downstream of the Arroyo de la Laguna confluence, flow changes in the segment of Alameda Creek within the extended study area that may result from operation of the proposed project were estimated through a comparison of recent gage flow and model-based estimated changes under the proposed project operations. The gage analysis revealed that for the 2001-2007 period, approximately one-third of the flow in Alameda Creek at Niles resulted from the upper Alameda Creek watershed. The remainder of the flow resulted from the Arroyo de la Laguna watershed (55 percent) and watershed near the mouth and within Niles Canyon (13 percent).

Because all SFPUC operations occur within the upper Alameda Creek watershed, implementation of the project would only affect approximately one-third of the upstream flow that contributes to flow at the Niles gage. As such, flow changes in upper Alameda Creek as a result of the project would be dampened in lower Alameda Creek by inflow from the Arroyo de la Laguna and Niles watersheds. For instance, a flow of 100 cfs in Alameda Creek above Arroyo de la Laguna could hypothetically be reduced by 25 percent in a given month with the project, resulting in a flow of 75 cfs for Alameda Creek upstream of Arroyo de la Laguna. The same hypothetical flow in Alameda Creek at the Niles gage would be 300 cfs without the project and 275 cfs with the project, corresponding to an 8 percent reduction.

Figure 4.6.16 details the predicted changes in flow in Alameda Creek at the Niles gage over the 8-year period (2000–2007) with implementation of the proposed project. The analysis shows that based on the hydrology from 2000 to 2007, reductions in flow in Alameda Creek at Niles Canyon would occasionally occur under implementation of the project. Reductions of up to 18 percent in average monthly flow could occur in years similar to Water Years 2000–2007. The maximum flow reduction would occur during January of an above-normal year and reductions would generally occur in the December to March timeframe of normal, above-normal, and wet years. The 2000 to 2007 period includes four of the five hydrologic year types (only a wet year is absent). However, as noted in the previous impact discussions, the greatest flow reductions resulting from implementation of the project would occur during normal and above-normal years, which are represented in the 2000–2007 data and the most significant flow reductions are therefore included in this analysis.

The largest predicted decrease in flow in lower Alameda Creek at the Niles gage would occur in a month similar to January 2005, with a reduction in average monthly flow of 46 cfs or 18 percent (as stated above) of the average monthly flow recorded in January 2005. Further review of the data reveals that flow reductions are calculated to occur in December through March of normal to wet years and April of wet years. In all other months, including winter months of below-normal and dry water years, flow in upper Alameda Creek and at the Niles gage would either remain the same or increase with implementation of the proposed project. However, diversions by ACWD (specifics regarding the frequency, magnitude, and duration of future diversions are unknown)

would further affect flows in the portion of Alameda Creek within the extended study area (i.e., at the mouth of Niles Canyon and lower Alameda Creek).

These predicted changes in the flow regime could result in associated small changes in habitat conditions in lower Alameda Creek; however, these potential changes would be diminished by operations of other water resource management entities in the watersheds that supply the Arroyo de la Laguna and would not be expected to result in changes to the extent that habitat conditions are currently limited in lower Alameda Creek for steelhead (downstream of the BART weir) or other fish species.

Impact Conclusion

Because predicted changes in the flow regime and associated changes in habitat conditions in lower Alameda Creek would be relatively small and would be diminished by operations of other water resource entities in the Arroyo de la Laguna watershed, operation of the proposed CDRP would not be expected to result in changes to habitat conditions in lower Alameda Creek for steelhead (downstream of the BART weir) or other fish species. The impact of project operations on native fish in Alameda Creek in the extended study area would therefore be less than significant.

Impact 4.5.9: Potential for conflict with local plans protecting fisheries and aquatic habitat.

The CDRP is located on CCSF lands within Alameda and Santa Clara Counties. The line dividing Alameda and Santa Clara Counties runs east to west through the northern portion of the Calaveras Dam and Reservoir. The proposed replacement dam and much of the project construction activity would be on the northern portion of the project site, on SFPUC lands located in eastern Alameda County and designated as “Water Management” under the *ECAP*. None of the construction areas are located in areas designated as “Resource Management” under the *ECAP*. The closest areas designated as “Resource Management” are adjacent to SFPUC-owned lands to the east of the Mission Peak Regional Preserve and north of the San Antonio Reservoir on both sides of State Route 84. Neither of these areas is in the primary or extended study area. Borrow Area E, Disposal Site 5, access roads, and biological mitigation areas would be located on SFPUC lands in Santa Clara County on lands designated as “Other, Public Lands” under the *Santa Clara County General Plan*. Most of the Calaveras, Arroyo Hondo, and Alameda Creek watersheds that supply Calaveras Reservoir are also in Santa Clara County. The primary study area, including the portion of the watershed under SFPUC control and the extended study area of Niles Canyon and lower Alameda Creek, does not have an adopted Habitat Conservation Plan. The SFPUC is working with the USFWS and NMFS to develop an HCP for incidental take of listed species that may result from SFPUC operations in the watershed, but none has been

adopted. Therefore, the analysis of potential conflicts focuses on adopted local plans and policies.

Neither Alameda County nor Santa Clara County has adopted policies or ordinances that specifically protect the resident rainbow trout, identified for purposes of this EIR as a special-status species. However, adopted policies under the county General Plans (e.g. *ECAP* Policy 125 and *Santa Clara County General Plan* Policy R-RC 19) encourage biological diversity through the protection of areas of functioning, intact natural ecosystems as well as areas known to support special-status species. Project-related construction activities would not result in the removal or degradation of fisheries habitat on property owned or leased by Santa Clara County, Alameda County, or the EBRPD. In order to protect water quality, a project-specific SWPPP would be developed for the SFPUC-owned watershed lands where construction is proposed to occur. The SWPPP would include site-specific BMPs (e.g. erosion and sediment controls and preservation of existing vegetation) that would result in minimizing turbidity and other water quality impacts, thus protecting sensitive fisheries and aquatic habitats in areas adjacent to and downstream (or down gradient) of disposal sites, borrow areas, or temporary project-related roads (see Section 5.7, Water Quality). As a result, project-related construction activities would not degrade downstream habitat in areas that may be owned or leased by Alameda County or the EBRPD.

Impact Conclusion

Construction of the CDRP and the extraction and disposal of dam building materials within the SFPUC-owned portion of the watershed would not result in a conflict with provisions of local plans intended to protect biological diversity. The CDRP is designed to avoid impacts on fisheries and aquatic habitats to the extent feasible and to mitigate potentially significant impacts on biological resources including fisheries. Construction activities would not remove substantial amounts of habitat for the resident rainbow trout, although some marginal habitat would be lost in Calaveras Creek for construction of the replacement dam. Direct impacts on native fish would be reduced to less-than-significant with the implementation of Mitigation Measure 5.5.1, which provides for the captured and relocation of fish in the dam construction area prior to construction. The loss of marginal habitat downstream of the existing dam would be a less-than-significant impact. Construction activities could result in temporary water quality impacts such as increased turbidity; these impacts would be mitigated to less-than-significant levels with implementation of BMPs described in the mitigation measures in Section 5.7, Water Quality. Operation of the proposed replacement dam, including releases of water to Alameda Creek pursuant to the 1997 MOU could improve habitat for resident rainbow trout and other aquatic species. Mitigation Measure 5.5.5a requires the SFPUC to develop and implement a monitoring program to ensure that the proposed flow releases are sufficient to sustain the resident trout population in Alameda Creek downstream of the ACDD. If monitoring shows that the proposed flow releases are not adequate to support the resident trout population, Mitigation Measure 5.5.5b requires the SFPUC

to implement adaptive management measures including additional flow releases, seasonal restrictions on operation of the ACDD, or installation of a fish screen at the diversion tunnel. Therefore, with the implementation of the proposed MOU flows from the ACDD bypass and Mitigation Measures 5.5.1, 5.5.5a, 5.5.5b, and 5.7.1, potential impacts on fisheries and aquatic habitat that could conflict with local goals and policies protecting biological resources would be less than significant.

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PERSONAL COMMUNICATIONS

- Moyle, P. Professor of Fish Biology. University of California, Davis. Conversation with Chris Fitzer and Alice Berg of EDAW regarding resident rainbow trout in the Alameda Creek watershed and the potential for fish entrainment at the ACDD and diversion tunnel, January 27, 2009.
- Sak, B. Biologist. SFPUC, Water Quality Bureau. Conversations with Chris Fitzer regarding fish sampling and fisheries community in Alameda Creek watershed, fall 2008.

4.6 HYDROLOGY

Section 4.6 Contents	
4.6.1 Setting	4.6.2 Impacts
4.6.1.1 Existing Conditions	4.6.2.1 Significance Criteria
4.6.1.2 Regulatory Framework	4.6.2.2 Approach to Analysis
	4.6.2.3 Project Impacts

This section describes Calaveras Reservoir and the creeks at and in the vicinity of the project site. The terminology used in this section for watershed units conforms to the State of California Interagency Watershed Map classification and subdivisions. Subsection 4.6.1, Setting, presents existing hydrology information for Calaveras Reservoir and the creeks found in the project area. It also describes the groundwater conditions in the Sunol Valley. Subsection 4.6.2, Impacts, defines the significance criteria and provides a description of the changes in streamflow, reservoir water levels, stream channel form, and groundwater conditions that would result from construction and operation of the project.

4.6.1 SETTING

4.6.1.1 EXISTING CONDITIONS

Subsection 4.6.1.1 Contents

Climate and Topography

Watersheds

 Greater Alameda Creek Hydrologic Area

 Project Watershed

 Sub-Watersheds of the Southern Alameda Creek Watershed

 Calaveras Reservoir Watershed

 Upper Alameda Creek Sub-Watershed

 San Antonio Sub-Watershed

 Mid-Alameda Creek Sub-Watershed

 Alameda Creek Watershed Extended Study Area, Downstream of Sunol Valley

Watercourses Supplying Calaveras Reservoir

 Arroyo Hondo

 Calaveras Creek

 Calaveras Creek Upstream of Calaveras Reservoir

 Calaveras Creek Downstream of Calaveras Reservoir

 Alameda Creek

 Alameda Creek Upstream of the ACDD

 Alameda Creek Downstream of the ACDD

 ACDD to Calaveras Creek Confluence

 Sunol Valley Reach

Subsection 4.6.1.1 Contents

continued

Memorandum of Understanding (MOU) with California Department
of Fish and Game

Gaged Flow

Alameda Creek Downstream of the Calaveras Creek Confluence

Alameda Creek Downstream of the Welch Creek Confluence

Alameda Creek Downstream of the Sunol Valley

Water Bodies and System Operations

Calaveras Reservoir

Calaveras Reservoir Operation

Releases from Calaveras Reservoir

Operation of ACDD

Pre-DSOD Operation of the ACDD

ACDD Baseline Operation (DSOD Restriction)

Flooding Hazards

Dam Failure Hazard

Geomorphology and Sediment Transport

Channel Morphology and Sediment Transport in the Primary Study Area

Streamflow and Alameda Creek Geomorphology

Gradient and Channel and Bank Materials

Upper Alameda Creek

Niles Canyon and Lower Alameda Creek

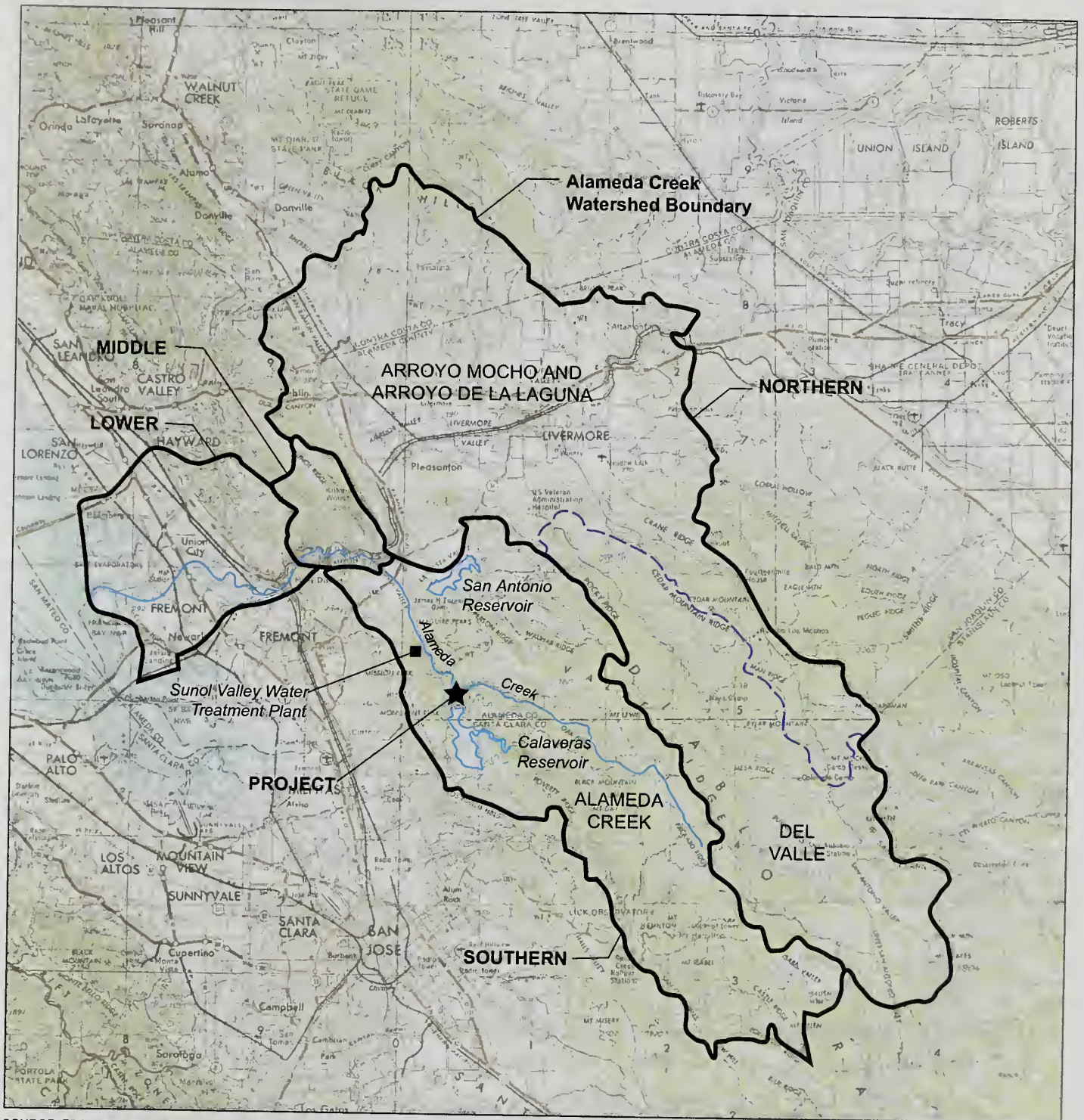
Groundwater

Upper Alameda Creek

Niles Canyon and Lower Alameda Creek

Groundwater Quality

The Alameda Creek watershed is an interior Coast Range drainage and the largest drainage in the southern San Francisco Bay region, draining roughly the southern two-thirds of the East Bay and discharging into southern San Francisco Bay (see Figure 4.6.1: Alameda Creek Drainage and Sub-Drainage Areas). The watershed is located within the South Bay Hydrologic Unit of the San Francisco Bay Hydrologic Region (California Inter-Agency Watershed Map of 1999 [calw 221], May 2004). The greater Alameda Creek Hydrologic Area (watershed) covers an area of approximately 633 square miles in the East Bay, 30 miles east of San Francisco. This section of the EIR focuses on the hydrology of the upper areas of the southerly portion of the Alameda Creek watershed, which accounts for approximately 32 percent, or 201 square miles, of the greater Alameda Creek Hydrologic Area.



SOURCE: EDAW & Turnstone JV.



CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.6.1: ALAMEDA CREEK DRAINAGE AND SUB-DRAINAGE AREAS

Climate and Topography

The Alameda Creek watershed generally experiences warm dry summers and cool rainy winters. To some degree, temperature ranges are moderated by the proximity of the watershed to San Francisco Bay; however, annual temperatures range higher and lower compared with San Francisco Bay ambient conditions.

Precipitation in the watershed is primarily in the form of rainfall, most of which falls in the mid-October through mid-April rainy season. Average annual precipitation in the East Bay ranges from about 10 to 30 inches per year and generally increases eastward from the Bay with increasing elevation to a maximum in the coastal hills, then drops rapidly with distance eastward from the hills (Welch et al. 1966, cited in Gunther et al. 2000, p. 10).

Mean annual precipitation in the project watershed (located in the coastal hills) ranges from approximately 19 to 26 inches, with the more substantial rainfall occurring in the upper reaches of the watershed upstream of Calaveras Dam and the Alameda Creek Diversion Dam (ACDD) (ACPWA 1994). The Alameda Creek watershed, like others on the central and southern California coast, is subject to periodic droughts.

Watersheds

Greater Alameda Creek Hydrologic Area

The Alameda Creek Hydrologic Area (watershed) can be generally divided into four major hydrologic sub-areas: southern/upper (the watershed within which the proposed project is located), northern, middle, and lower. Two main watercourses define the southern and northern portions of the hydrologic area, namely Alameda Creek and Arroyo de la Laguna, respectively. The middle watershed begins at the confluence of Alameda Creek and Arroyo de la Laguna and extends through Niles Canyon. The lower watershed begins where Alameda Creek exits Niles Canyon and extends to San Francisco Bay. The natural hydrology of the Alameda Creek Hydrologic Area has been largely altered by water supply development and flood control facilities.

In the upper reaches, Alameda Creek flows through a series of narrow alluvial valleys, linked by narrow bedrock-channel corridors, and flanked by moderately steep to steep hills covered by grassland and scrub. The watershed is predominantly green space comprised of hill lands. In the Sunol Valley and other alluvial flats, Alameda Creek flows through a broad open valley which is used for gravel mining and other predominantly rural uses, and is joined by Arroyo de la Laguna at the base of the Sunol Valley. Further downstream, Alameda Creek cuts through the incised Niles Canyon and is confined by steep rocky hill slopes. Finally, Alameda Creek flows across the San Francisco Bay plain through urban areas before discharging into San Francisco Bay.

The southern hydrologic sub-area of the Alameda Creek Hydrologic Area, including the project area, is characterized by steep gradient streams flowing in bedrock-channel corridors in steep to moderately steep hill lands with grassland and oak woodland cover. The sub-area is sparsely settled ranch grazing and wildlands along upper Alameda Creek within Sunol and Ohlone Wilderness Regional Preserves and San Francisco Public Utilities Commission (SFPUC) watershed lands. The southern watershed includes the Arroyo Hondo, Calaveras Creek, Welch Creek, and San Antonio Creek tributaries. Water supply development in this portion of the watershed includes Calaveras Reservoir, ACDD, Sunol Valley Water Treatment Plant (SVWTP), and San Antonio Reservoir.

The northern hydrologic sub-area of the Alameda Creek Hydrologic Area is predominantly wildland, grazing land, and agricultural lands and includes the rapidly urbanizing cities of Livermore, Pleasanton, Dublin, and San Ramon in the Amador Valley along the Arroyo Mocho and Arroyo de la Laguna tributaries. Water supply development in the northern watershed includes Lake Del Valle and the flooded quarries of Shadow Cliffs. Substantial segments of the watercourses have been altered for flood control.

The middle hydrologic sub-area includes an approximately 6.5-mile stretch of Alameda Creek with the Sinbad and Stonybrook Creek tributaries in Niles Canyon and the town of Niles. This segment of watershed includes the historical water supply development of the Sunol and Niles Dams and groundwater infiltration galleries; however, the above-grade portions of the Sunol and Niles Dams were removed by the SFPUC in 2006. Flow in this segment of the watershed is also influenced by releases from the South Bay Aqueduct into Vallecitos Creek on Arroyo de la Laguna near the confluence with Alameda Creek. This water is diverted from Alameda Creek downstream in the lower watershed by Alameda County Water District (ACWD) for the purposes of municipal and domestic supply.

The lower hydrologic sub-area includes approximately 11 miles of Alameda Creek from where it emerges from Niles Canyon and flows across the San Francisco Bay plain to its discharge points in San Francisco Bay. This area is largely characterized by urban development in the cities of Fremont, Union City, and Newark. The segment of Alameda Creek in this area largely has been altered for flood control and includes a large weir at the Bay Area Rapid Transit (BART) tracks (the BART weir) and inflatable dams for the diversion of water to flooded quarries for recharge of groundwater. The inflatable dams are owned and operated by ACWD and are used to divert both natural creek flow and state water discharged into Vallecitos Creek (and ultimately Alameda Creek) upstream of Niles Canyon. Downstream of the weir, Alameda Creek flows within levee-controlled channels to discharge points in San Francisco Bay.

Alameda Creek is usually a perennial stream in the upper parts of the watershed, but in the Sunol Valley and other alluvial flats, a high rate of infiltration and through-flow normally results in a

dry creek bed during the summer months. The creek then resurfaces as pools in the confined bedrock canyons. Many of the tributaries that supply flows to the creek are historically intermittent and can be isolated from the main stem beginning in early to mid-summer (Welch et al. 1966, cited in Gunther et al. 2000). The primary exception to this is Arroyo Hondo, which has year-round flow in many locations. In addition to fluctuations in streamflows caused by varying levels of surface water runoff, flows in Alameda Creek tributaries also vary greatly with rising and falling water tables in the area (Gunther et al. 2000) and with operation of dams in the watersheds. These creeks and existing reservoirs, including Calaveras Reservoir, are shown on Figure 4.6.1.

Project Watershed

The southern Alameda Creek sub-hydrologic area occupies about 201 square miles between Pleasanton to the north and Mount Hamilton to the south, with portions located within Alameda and Santa Clara Counties. Natural drainage flows from the hills toward San Francisco Bay via Alameda Creek. Alameda Creek is identified as the master stream (California Interagency Watershed Map 2004). The upper portions of Alameda Creek are divided into three sub-watersheds as follows: (1) Calaveras Creek and Arroyo Hondo; (2) upper Alameda Creek with five sub-watersheds; and (3) San Antonio Creek with three sub-watersheds (California Interagency Watershed Map 2004).

The SFPUC owns 56 square miles (36,000 acres), a little less than one-third, of the southern Alameda Creek sub-hydrologic area (see Figure 4.6.2: Sub-Watersheds and Major Hydrologic Features of the Project Watershed). Much of the upper, or southern, watershed is managed as public parklands by the East Bay Regional Parks District (EBRPD), or protected for water supply by the SFPUC. The SFPUC *Alameda Watershed Management Plan* (2001) classified Alameda Creek watershed lands as primary and secondary watershed lands. The 30,000 acres of primary watershed lands are tributary to San Antonio and Calaveras Reservoirs and Alameda Creek. The 6,000 acres of secondary watershed lands are tributary to Alameda Creek. The proposed project is located in the SFPUC-owned primary watershed lands, the most sensitive lands in terms of water quality protection, because drainage from these areas flows directly into SFPUC storage reservoirs and drinking water intakes.

The SFPUC manages the Alameda Creek watershed portion of the regional water supply system with the primary objective of conserving local watershed runoff for delivery to customers. Calaveras Reservoir is a key water storage facility of the SFPUC and has the largest capacity of the reservoirs supplied by local runoff in the Bay Area. It is the only SFPUC reservoir in the Bay Area which receives all of its water from local watershed runoff. Water stored in Calaveras Reservoir is directly conveyed in the 4.1-mile-long Calaveras Pipeline to the SVWTP and from there directed into the water supply transmission system. Thus, Calaveras Reservoir is a stand-

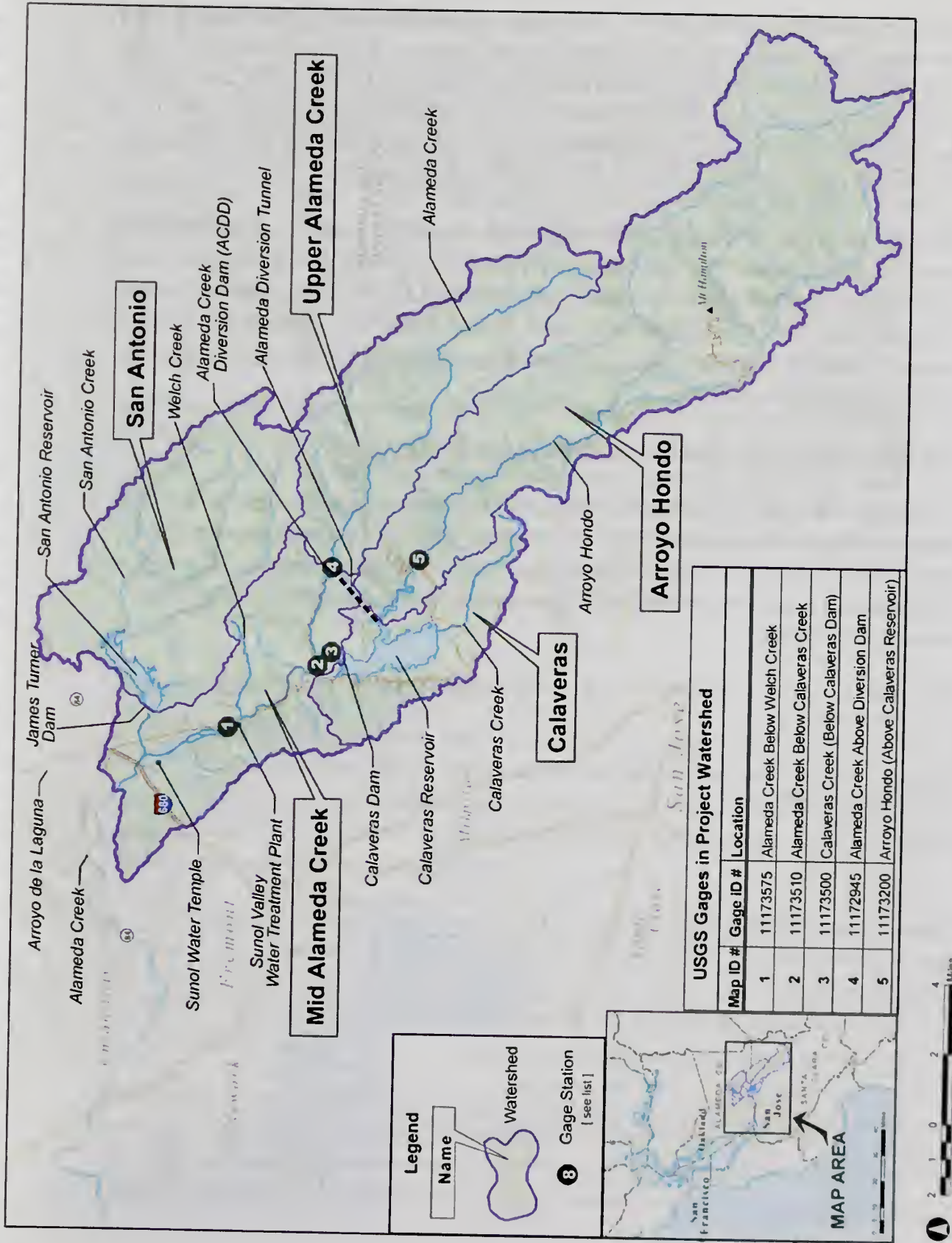


FIGURE 4.6.2: SUB-WATERSHEDS AND MAJOR HYDROLOGIC FEATURES OF THE PROJECT WATERSHED

2005.0161E / Calaveras Dam Replacement Project

alone storage facility within the SFPUC water supply system. The other SFPUC reservoir in the watershed is San Antonio Reservoir. Unlike Calaveras Reservoir, San Antonio Reservoir stores local watershed runoff, water supplied via pipeline from the Hetch Hetchy system, and water that can be conveyed on occasion from Calaveras Reservoir. In addition, the Alameda Creek watershed reservoirs are managed to capture local winter and spring runoff in order to maximize carryover storage in combination with the Hetch Hetchy system storage.

This interconnectivity of the management of the Alameda and Hetch Hetchy systems provides for substantial flexibility in SFPUC operations for water supply. At times when the Hetch Hetchy system must be shut down for maintenance and repair, Calaveras and San Antonio Reservoirs are used for supply. San Antonio Reservoir may also be used to store imported Hetch Hetchy water; however, Calaveras Reservoir captures and stores only local runoff. The reservoirs also provide back-up supplies during droughts.

Sub-Watersheds of the Southern Alameda Creek Watershed

The southern Alameda Creek watershed is divided into a series of sub-watersheds for the purposes of this discussion of hydrology. Sub-watersheds were defined based on water supply infrastructure in the watershed and include Arroyo Hondo, Calaveras Creek, upper Alameda Creek, mid-Alameda Creek, and the San Antonio watershed, as shown on Figure 4.6.2, and summarized in Table 4.6.1.

Table 4.6.1: Areas of Sub-Watersheds in the Project Area

	Sub-Watershed Area	
	Acres	Square Miles
Calaveras Reservoir		
Arroyo Hondo	51,969	81.2
Calaveras Creek	10,693	16.7
Subtotal	62,662	97.9
Upper Alameda Creek (upstream of ACDD)	21,679	33.9
San Antonio Reservoir	24,645	38.5
Mid Alameda Creek		
ACDD to USGS Gage at Calaveras Creek Confluence	4,553	7.1
Calaveras Creek Confluence Gage to Welch Creek Gage	6,307	9.9
Welch Creek Gage to San Antonio Creek Confluence	3,882	6.1
San Antonio Creek Confluence to Arroyo de la Laguna Confluence	4,746	7.4
Subtotal	19,488	30.5
TOTAL	128,474	200.8

Source: ETJV 2007 GIS

Calaveras Reservoir Watershed

The natural drainage contributing to Calaveras Reservoir includes the Arroyo Hondo and Calaveras Creek sub-watersheds with a total area of approximately 98 square miles. The two major watercourses in these sub-watersheds are Arroyo Hondo and the majority of Calaveras Creek. The Calaveras Reservoir watershed starts along Jays Ridge at the southernmost tip of the Alameda Creek watershed. Runoff drains into Isabel Creek, which flows into Arroyo Hondo north of Mount Hamilton. Arroyo Hondo flows in a northwesterly direction towards Calaveras Reservoir. From its headwaters to Calaveras Reservoir, Arroyo Hondo is almost 26 miles in length. Calaveras Creek flows for approximately 6 miles prior to reaching the Calaveras Reservoir impoundment. Historically, Arroyo Hondo was a tributary to Calaveras Creek; however, the lower reach and confluence have been inundated by Calaveras Reservoir.

Land in the Calaveras Creek and Arroyo Hondo sub-watersheds is almost entirely open green space; land uses include scattered low-density residential, grazing activities, and watershed protection. Most of the land in the sub-watersheds, including the area surrounding Calaveras Reservoir, has high topographic relief and thus is highly susceptible to erosion. The average overland slope for this sub-basin is 42 percent. U.S. Soil Conservation Service maps indicate soil types are predominately type C and D (slow to very low infiltration potential) (WRE 2000). As a result, precipitation in the watershed rapidly runs off the slope and collects in the drainage channels.

Upper Alameda Creek Sub-Watershed

The Upper Alameda Creek sub-watershed is approximately 34 square miles and covers the area draining into Alameda Creek from its origin near Valpe Ridge and Packard Ridge to the ACDD. It is made up of three distinct drainage areas: Valpe Creek, Whitlock Creek, and Alameda Creek proper. Land in this area is almost entirely open space used for grazing and watershed protection, and some scattered low-density residential.

This sub-watershed is delineated based on the ACDD, which diverts flow from Alameda Creek to Calaveras Reservoir through the diversion tunnel. As shown in Figure 4.6.2, the diversion tunnel is situated about 2 miles upstream from the confluence with Calaveras Creek. At this overflow-type diversion, streamflow backs up behind an impoundment, is directed into a channel, and then enters the diversion tunnel.

Alameda Creek flows approximately 15 miles from its headwaters to the diversion at ACDD. Upstream of the ACDD, slopes along Alameda Creek are steep and eroded or severely eroded, with slope angles as high as about 45 percent (SFPUC 2001). The average overland slope for this sub-basin is 40 percent. U.S. Soil Conservation Service maps indicate soil types are primarily

type C (slow infiltration potential) (WRE 2000). Like Calaveras Creek and Arroyo Hondo, the steep slopes and low infiltration result in high and rapid runoff into upper Alameda Creek.

San Antonio Sub-Watershed

The San Antonio sub-watershed encompasses the entire area draining into San Antonio Reservoir. Nine mapped creeks flow into San Antonio Reservoir, including several local drainages: Apperson, Indian, and San Antonio Creeks. The average slope for this sub-watershed is 31 percent (WRE 2000). Land within the San Antonio sub-watershed is largely open green space, with grazing and seasonal recreational uses. San Antonio Reservoir and sub-watershed are discussed only to the extent that they influence flow in Alameda Creek.

Mid-Alameda Creek Sub-Watershed

The mid-Alameda Creek sub-watershed is defined at the top of the watershed by the ACDD and Calaveras Dam, and at the bottom by the confluence with Arroyo de la Laguna. Inflow to the watershed includes spills/releases from Calaveras Dam, spills over ACDD, spills/releases from Turner Dam at San Antonio Reservoir,¹ and unregulated inflow from the slopes and minor tributaries of the sub-watershed. The mid-Alameda Creek sub-watershed can be further subdivided into a number of sub-drainages based on U.S. Geological Survey (USGS) gages and major confluences with other creeks, which include the following:

- The area from ACDD and Calaveras Dam to the confluence with Calaveras Creek, including Calaveras Creek downstream of the dam;
- The area between Calaveras Creek confluence and the Welch Creek confluence;
- The area draining into Alameda Creek between Welch Creek and San Antonio Creek confluences including San Antonio Creek downstream of Turner Dam; and
- The area draining into Alameda Creek between the San Antonio confluence and the confluence with Arroyo de la Laguna.

Upstream of the confluence with Arroyo de la Laguna, flow in Alameda Creek in this sub-watershed is almost entirely controlled by operation of the SFPUC facilities identified above.

The mid-Alameda Creek sub-watershed is mostly undeveloped near Calaveras Reservoir. The sub-watershed is largely altered by gravel quarries near the bottom of the sub-watershed in the vicinity of San Antonio Creek. Most flow entering the mid-Alameda Creek sub-watershed is regulated except for the small amount of local drainage within the basin itself. Average slopes are variable, between 4 and 45 percent (WRE 2000). According to U.S. Soil Conservation Service maps, this sub-watershed has primarily soil types B and D (slow to moderate infiltration).

¹ San Antonio Reservoir rarely spills and San Antonio Creek generally has very little to no flow below Turner Dam. This reach was usually dry for many months of the year prior to construction of Turner Dam.

Infiltration of surface flow is largely in the lower portion of the watershed in the vicinity of the quarries.

The primary study area is confined to the southern Alameda Creek Watershed, which terminates at the Arroyo de la Laguna confluence. The extended study area, described below, includes the middle and lower watersheds of Alameda Creek that are downstream of the confluence with the Arroyo de la Laguna (Sunol Valley to San Francisco Bay).

Alameda Creek Watershed Extended Study Area, Downstream of the Sunol Valley

Downstream of the Sunol gravel quarries and downstream of the confluence of Arroyo de la Laguna, Alameda Creek flows through the Sunol Ridge in Niles Canyon for approximately 6.5 miles. This watershed area is identified in Figure 4.6.1 as the middle and lower Alameda Creek watersheds. Flow entering this portion of the watershed is generated in the southern (primary study area) and northern Alameda Creek watersheds. Flow from the northern watershed is influenced by operation of Del Valle Reservoir and water deliveries to the Alameda County Water District (ACWD) from the South Bay Aqueduct, which are released to Arroyo de la Laguna just upstream from the Alameda Creek confluence. Because of urbanization and alterations to drainage in Dublin, Pleasanton, and Livermore, substantial hydromodification in the Tri-Valley area has occurred since the 1960s. The northern Alameda Creek watershed drained by the Arroyo de la Laguna and Arroyo Mocho is not discussed further here because the project would have no impact in that area.

The stream channel in the middle Alameda Creek watershed is relatively confined within the steep canyon and, aside from Highway 84 and a rail line, there is little development on the narrow floodplain and surrounding hills. There is a relatively well developed riparian zone throughout Niles Canyon. There are two major tributaries in this reach, Sinbad Creek and Stonybrook Creek. The reach is a relatively low gradient (1 to 2 percent) perennial stream characterized by large, moderately deep pools, and runs separated by short, shallow riffles (Buchan et al. 1999).

Downstream of Niles Canyon in the lower watershed, the creek enters the San Francisco Bay plain and ultimately discharges to San Francisco Bay. The creek is channelized along most of the reach in the watershed downstream of Niles Canyon. The creek was extensively modified beginning in the 1950s as a result of urbanization, instream aggregate extraction, and the construction of flood control and water conveyance facilities (Buchan et al. 1999). In 1972, Alameda Creek was rerouted into a trapezoidal flood control channel confined between artificial levees. Maintenance of flood capacity requires periodic removal of sediment and vegetation from the channel. The historical floodplain has been largely converted to residential, commercial, and industrial urban uses including industrial salt production. Water supply facilities operated by ACWD and flood control structures operated by the Alameda County Flood Control and Water Conservation District (ACFCWCD) have been constructed in the channel. They include a grade

control structure at the BART rail crossing (the BART weir) and a series of ACWD inflatable dams for water supply impoundment, local aquifer recharge, and diversion.

Watercourses Supplying Calaveras Reservoir

Three major watercourses supply flow to Calaveras Reservoir: Arroyo Hondo, Calaveras Creek, and upper Alameda Creek via the ACDD and diversion tunnel. Calaveras Reservoir releases flow back to Calaveras Creek, which joins Alameda Creek less than 1 mile downstream of Calaveras Dam. Downstream of this confluence, Alameda Creek flows through the Sunol Valley and is joined by Welch Creek and San Antonio Creek and Arroyo de la Laguna before entering Niles Canyon (see Figure 4.6.2). Further detail on watercourses is provided in Section 4.5, Fisheries and Aquatic Habitat.

The seasonal patterns of streamflow in the southern Alameda Creek watercourses are typical of central California coastal streams. Streamflows are relatively high from December through April and tend to be highest in February. During the dry season (i.e., mid-April through mid-October), flows in the upper reaches of the creeks drop to very low levels. Flow in the Arroyo Hondo upstream of Calaveras Reservoir averages about twice that in upper Alameda Creek on a monthly basis, and this difference in flow is consistent with contributing watershed area. Although there is a rather uniform annual pattern of flow over the period of record, monthly and daily averages can be highly variable in both timing and magnitude, depending on annual and seasonal variation in precipitation. Streamflows in the upper watershed areas tend to respond quickly during precipitation events, with rapid increases to relatively high levels and then rapid declines between events. This characteristic pattern is sometimes referred to as “flashy” flow. Base flow levels between storms are relatively low except during frequent storms, like those in March 2006 (ETJV 2007).

Several USGS gages are located on these watercourses; however, most have limited data records. Pertinent USGS gages and the associated periods of record that are located on these watercourses are identified in Table 4.6.2. Yearly gage data presented in Table 4.6.2 are expressed in water years.²

² Water year is the 12-month period from October 1 through September 30. These dates are used in California to establish the typical beginning of the wet period. The water year is designated by the calendar year in which it ends (for example, the year ending September 30, 2006 is called the “2006 water year”).

Table 4.6.2: Gages and Available Data on Watercourses in the Project Vicinity

Gage	Period of Record																
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
11173200 Arroyo Hondo (Above Calaveras Reservoir)	*																
11173500 Calaveras Creek (Below Calaveras Dam)	**																
11172945 Alameda Creek Above ACDD																	
11173510 Alameda Creek Below Calaveras Creek																	
11173575 Alameda Creek Below Welch Creek																	
11179000 Alameda Creek Near Niles	***																

Notes

* Data also available from 1968-1987 for Arroyo Hondo

** Calaveras Creek Gage recorded only low flow (below 200 cfs) before September 2006.

*** Niles gage has extensive period of record, 1891 to present

Sources: USGS 2009a, 2009b, 2009c, 2009d, 2009e, 2009f

Arroyo Hondo

Arroyo Hondo, the primary watercourse supplying Calaveras Reservoir, has a creek length of 26 miles, with an average slope of 77 feet per mile. A USGS gage is located on Arroyo Hondo upstream of Calaveras Reservoir. Monthly statistics from the Arroyo Hondo gage are presented in Table 4.6.3, and average daily flows are presented in Figure 4.6.3a: Daily Flow in Arroyo Hondo Upstream of Calaveras Reservoir, Water Years 1998–2009.

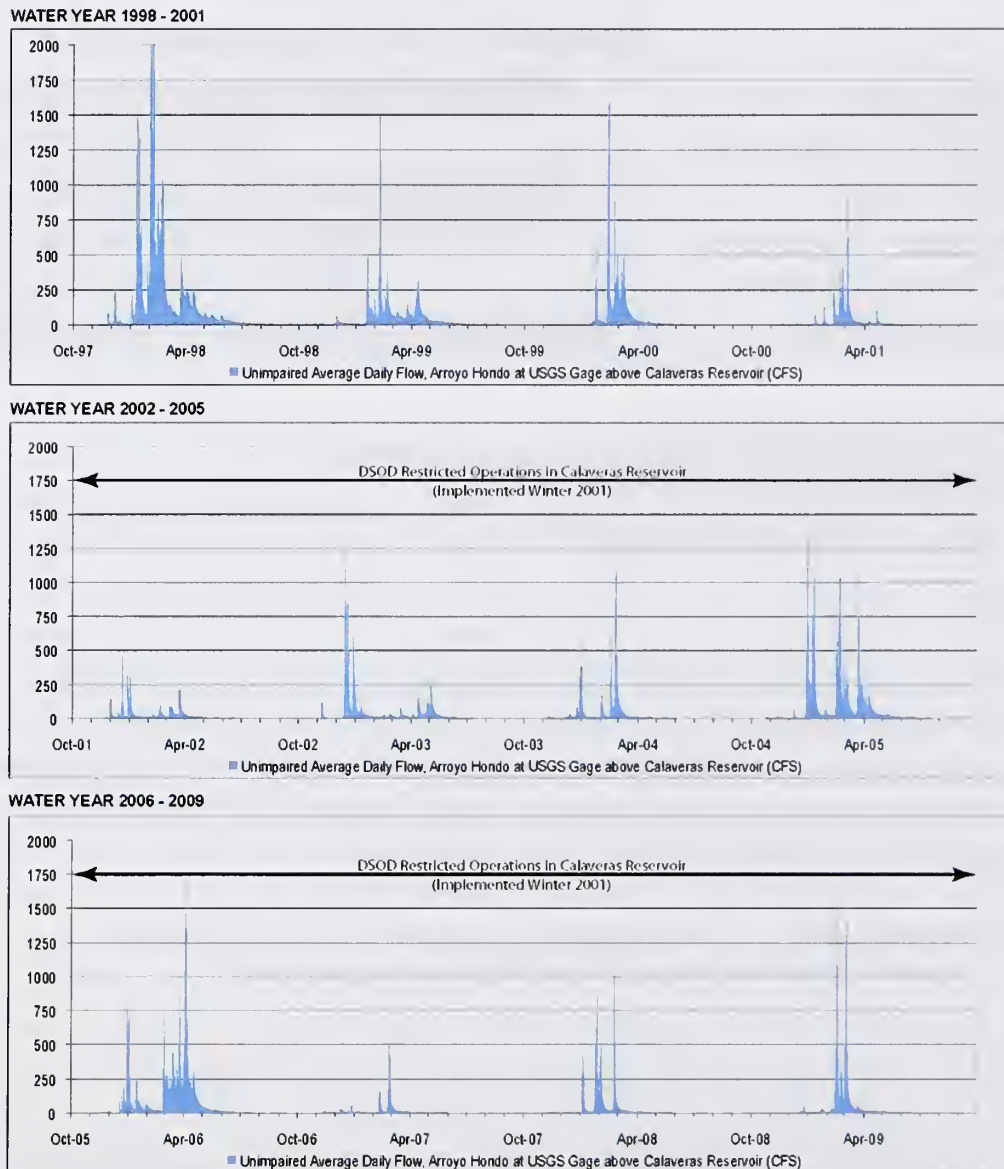
Table 4.6.3: Monthly Flow in Arroyo Hondo Upstream of Calaveras Reservoir, Water Years 1968–1984, 1995–2009 (cubic feet per second)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	1.6	11	54	158	191	127	56	17	6.6	2.7	1.4	1.1
Max Daily Avg	31	527	1,530	3,580	3,470	2,970	1,820	295	44	31	31	30
Min Daily Avg	0.2	0.28	1.1	2.4	2.3	2.8	1.7	0.95	0.46	0.11	0.15	0.14
% of Average Annual Flow	0.3%	1.8%	8.6%	25%	30%	20%	8.9%	2.7%	1.1%	0.4%	0.2%	0.2%

Source: USGS 2009a

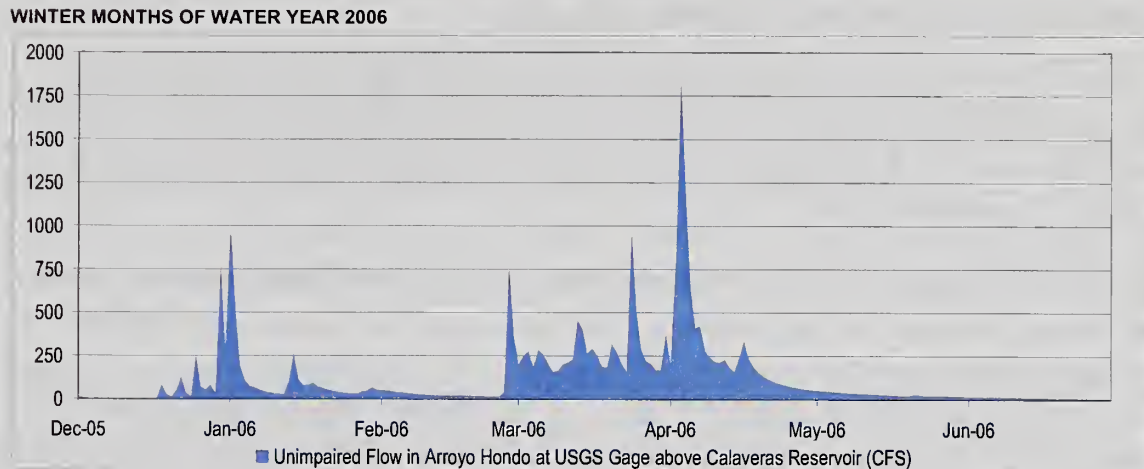
A review of gage data in Arroyo Hondo Upstream of Calaveras Reservoir, Water Years 1968–1984, 1995–2009, reveals both the seasonality of flow in the creek and the “flashy” nature of its flow (i.e., brief periods of high flows interspersed with longer periods of low flows). The range of monthly flows has been over 3,500 cubic feet per second (cfs) in winter months and flows have been as low as 0.11 cfs in summer months. Figure 4.6.3b: Average Daily Flow in Arroyo Hondo

Figure 4.6.3a: Average Daily Flow in Arroyo Hondo Upstream of Calaveras Reservoir, Water Years 1998–2009



Source: USGS 2009a

Figure 4.6.3b: Average Daily Flow in Arroyo Hondo Upstream of Calaveras Reservoir, Winter Months of Water Year 2006



Source: USGS 2009a

Upstream of Calaveras Reservoir, Winter Months of Water Year 2006, presents winter months of Water Year 2006 to better illustrate the flashy nature of the creek. Given the wide range of data recorded, the monthly average flows are useful primarily as a depiction of the seasonal pattern of flow. Three months – January, February, and March – account for 76 percent of the average annual flow in Arroyo Hondo, while four months – July, August, September, and October – account for only 1 percent of the average annual flow.

California Department of Water Resources (DWR), Division of Safety of Dams (DSOD) restrictions on the Calaveras Reservoir water levels have resulted in a segment of Arroyo Hondo flowing through the reservoir's pre-2001 drawdown zone that has been exposed year round during the baseline period. This segment of the creek has shallow riffles and little vegetation. During the operation of Calaveras Reservoir before the DSOD restriction, Arroyo Hondo was fully inundated by the reservoir in that area for most of the year. The spillway approach is at Elevation 756 feet. From 1938 to 1991, spills have occurred 18 times and thus Arroyo Hondo was inundated at least to the spillway elevation and likely somewhat higher. For example, from 1993 to 2001, reservoir elevation in Arroyo Hondo commonly ranged between a low of about Elevation 735 feet to about Elevation 760 feet (URS 2008, Figure 3). The lowered pool level was initiated in 2001 and the range dropped to a low below Elevation 690 feet and a high of about elevation 732 feet (during the wet spring of 2006). Thus, during the baseline period of DSOD water level restrictions, the lowered reservoir established the current course of Arroyo Hondo across the drawdown area. In Section 4.5, Fisheries and Aquatic Habitat, the upper parts of Arroyo Hondo about 1 mile above the pre-DSOD restriction reservoir pool are designated as Reach AH-1 and AH-2 (see Figure 4.5.2).

Calaveras Creek

Calaveras Creek Upstream of Calaveras Reservoir

Calaveras Creek has a much smaller watershed than Arroyo Hondo, with a total creek length upstream of Calaveras Reservoir of approximately 6 miles and an average slope of 152 feet per mile. In Section 4.5, Fisheries and Aquatic Habitat, this segment of the creek is designated as Reach C-2 (see Figure 4.5.1).

No USGS flow gages are located in Calaveras Creek upstream of Calaveras Reservoir. Before the original Calaveras Dam was constructed, there was a gage in or near the current location of the gage downstream of Calaveras Dam and downstream of Arroyo Hondo. That historical gage, however, recorded only a short period of flow data. As watershed characteristics are similar to those of Arroyo Hondo, streamflow in Calaveras Creek can be approximated by a watershed area ratio between the Calaveras Creek and Arroyo Hondo basins. Calaveras Creek and Arroyo Hondo provide an average combined inflow to Calaveras Reservoir of about 36,000 acre-feet per year (AFY) (Bookman-Edmondston 1995), with approximately 17 percent of this inflow attributed to Calaveras Creek. Inflow to Calaveras Reservoir from Calaveras Creek and Arroyo Hondo has varied from essentially no runoff (1924) to almost 151,000 acre-feet (AF) (1983) in a year (SFPUC 2007).

As with the Arroyo Hondo, a small segment of the creek currently flows through the former drawdown zone at the upper end of Calaveras Reservoir as a result of DSOD-restricted water levels.

Calaveras Creek Downstream of Calaveras Reservoir

The reach of Calaveras Creek downstream of Calaveras Reservoir has a length of 0.9 mile, with an average slope of 236 feet per mile. In Section 4.5, Fisheries and Aquatic Habitat, this segment of the creek is designated as Reach C-1 (see Figure 4.5.1). Flow in this reach of the creek is controlled by releases from Calaveras Reservoir and dam seepage. When the reservoir is full, dam seepage is estimated at 0.5 to 1 cfs (CDFG 1997). Flow recorded at the USGS gage on this section of creek is regularly less than 0.2 cfs when releases from Calaveras Dam are not being made.

Under baseline conditions, the reservoir elevation has been maintained mostly by normal withdrawals through the Calaveras Pipeline to the SVWTP and by occasional releases from the 72-inch-diameter cone valve to draw down the reservoir rapidly during periods of high inflow to the DSOD-allowed elevation of 705 feet. The cone valve is rated for releases up to approximately 1000 cfs, and an instantaneous flow in Calaveras Creek downstream of the gage was recorded on April 25, 2006, of up to 1,070 cfs. Average daily flow in the creek however, has not exceeded 400 cfs since the modern record began in May 2002 (USGS 2009a). The cone

valve below Calaveras Dam also is periodically operated for maintenance purposes. In 2006, the SFPUC installed a temporary 12-inch flow release valve for studies of fishery and aquatic habitat.

The USGS gage was recently installed in Calaveras Creek downstream of Calaveras Reservoir, with data available from May 2002 to the present. Flow rates in this reach of the creek are assumed to have generally increased in volume and duration in comparison with similar past hydrologic years under the pre-DSOD restricted operating condition, due to increased releases required at present to maintain the lowered reservoir water level. Gage flow records for this reach only exist for Water Year 2003 to the present (as well as for a few years prior to original dam construction).

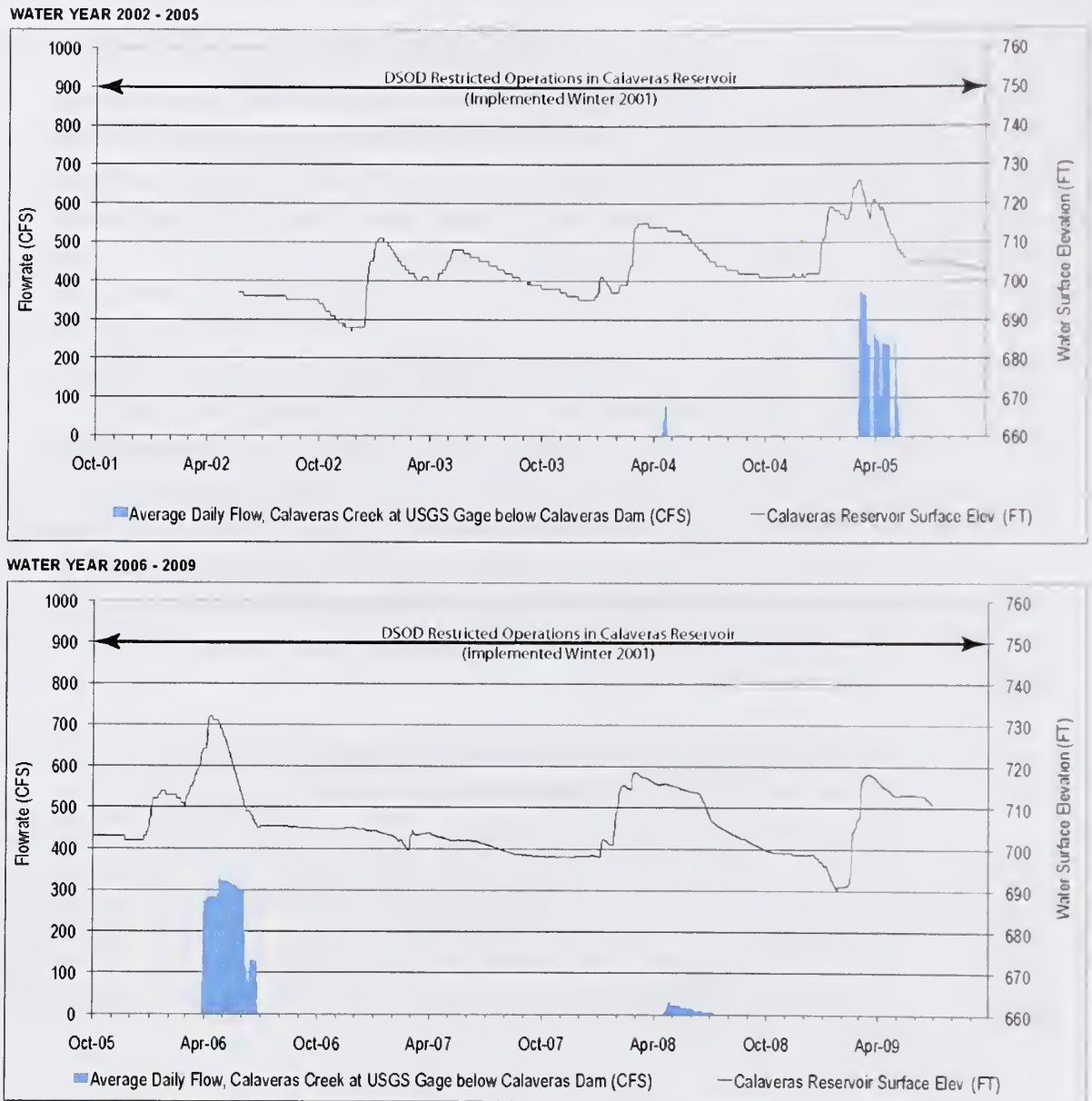
Figure 4.6.4: Average Daily Flow in Calaveras Creek Downstream of Calaveras Reservoir, Water Years 2002-2009, presents the recent daily flow record and reservoir surface water elevations over that period. Table 4.6.4 presents the monthly statistics over the period 2003-2009. The figure clearly shows periods of release from Calaveras Dam (corresponding with dropping water surface elevation) followed by long periods of very little base flow. Other periods of steeply dropping water surface elevation without flow spikes in Calaveras Creek indicate diversions for water supply and, to a much lesser degree, evaporation from Calaveras Reservoir. Analysis of the gage data indicates that flows in Calaveras Creek were less than 0.2 cfs in 85 percent of days in Water Years 2003-2006.

Table 4.6.4: Monthly Flow in Calaveras Creek Downstream of Calaveras Reservoir, Water Years 2003–2009 (cubic feet per second)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	0.0	0.0	0.1	0.1	0.1	42	81	61	22	0.3	0.0	0.0
Max Daily Avg		0.4	0.9	0.4	0.4	373	336	323	298	6.3	0.3	0.3
Min Daily Avg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% of Annual Flow	0.0%	0.0%	0.0%	0.0%	0.0%	20%	39%	30%	11%	0.1%	0.0%	0.0%

Source: USGS 2009b

Figure 4.6.4: Average Daily Flow in Calaveras Creek Downstream of Calaveras Reservoir, Water Years 2002–2009



Note: Calaveras Creek Gage began operation in May 2002.

Note: Entire period presented is during DSOD restricted operations. The flow rates presented in this chart are daily averages and instantaneous flow rates in Calaveras Creek have exceeded the daily averages. The highest recorded instantaneous flow during this period of record was 1,070 cfs on 4/25/06.

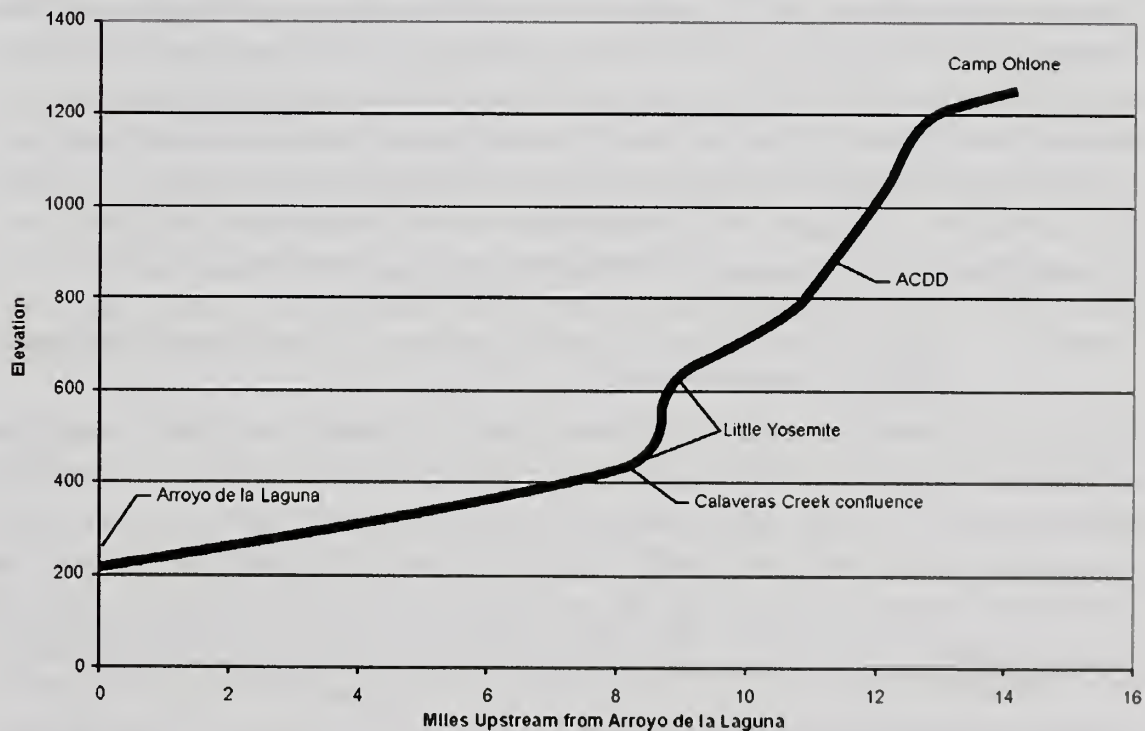
Source: USGS 2009b

Alameda Creek

In the project watershed, Alameda Creek flows from its headwaters near Mount Hamilton northward through the upper Alameda Creek watershed and the Sunol Valley. In this reach, Alameda Creek is joined by Calaveras, Welch, and San Antonio Creeks and by Arroyo de la Laguna. Downstream of the Arroyo de la Laguna confluence, Alameda Creek leaves the Sunol Valley and enters the Niles Canyon reach. The principal tributary in this reach is Stonybrook Creek. Downstream of the canyon, Alameda Creek flows across the San Francisco Bay plain and within a levee-controlled flood control channel until ultimate discharge into San Francisco Bay. Because of the levees, there are no notable tributaries to Alameda Creek present in this reach.

An elevation profile along Alameda Creek within the southern watershed is shown in Figure 4.6.5: Alameda Creek Elevation Profile, Camp Ohlone to Arroyo de la Laguna. Grade in the creek changes notably at the Calaveras Creek confluence, with a relatively steep profile in the upper reaches of the watershed and a much more gradual slope in the Sunol Valley.

Figure 4.6.5: Alameda Creek Elevation Profile, Camp Ohlone to Arroyo de la Laguna



Source: ETJV 2007

Alameda Creek Upstream of the ACDD

Alameda Creek upstream of the ACDD has a reach length of 14.9 miles with an average slope of 125 feet per mile. In Section 4.5, Fisheries and Aquatic Habitat, this segment of the creek is designated as Reaches A-5 and A-6 (see Figure 4.5.1).

The average annual streamflow in Alameda Creek at the ACDD has been estimated at 12,000 AF by Bookman-Edmondston 1995 and modeled at 12,880 AF by SFPUC in 2006 (SFPUC 2009). Streamflow in upper Alameda Creek is flashy. The configuration of the ACDD does not allow for provision of a bypass flow to Alameda Creek when flow is being diverted to Calaveras Reservoir. When the ACDD gates are open, the entire flow of Alameda Creek up to about 650 cfs is diverted. Flows exceeding about 650 cfs spill over the dam and continue downstream in Alameda Creek. Under current DSOD-restricted conditions, flows have been diverted more intermittently than they were historically during the pre-DSOD-restricted condition. Operation of Calaveras Dam under the current DSOD restriction is discussed below under “Water Bodies and System Operations.”

A USGS gage (11172945) is located approximately 700 feet upstream of the ACDD. The gage began operation in Water Year 1995, with daily records up to the present. Table 4.6.5 provides a summary of flows at this USGS gage. These data are indicative of the intermittent and flashy nature of Alameda Creek flows. In normal years, Alameda Creek obtains 76 percent of its average flow in January, February, and March, whereas August–October shows little or no flow. A daily maximum flow of about 2,700 cfs occurred in winter 2002/2003 (see Figure 4.6.10, Unimpaired Inflow, Diversions, and Calculated Spill at ACDD, Water Years 1998–2009, presented later in this section under “ACDD Baseline Operation (DSOD Restriction).”).

Table 4.6.5: Monthly Flow in Alameda Creek Upstream of ACDD, Water Years 1995-2009 (cubic feet per second)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	0.2	2.7	29	84	88	58	26	9.7	3.3	1	0.36	0.21
Max Daily Avg	2	354	602	1,200	1,120	1,090	524	208	18	6	3	2
Min Daily Avg	0	0	0.02	0.46	1.2	4.3	2.4	0.93	0.23	0	0	0
% of Av. Annual Flow	0.1%	1%	10%	28%	29%	19%	9%	3%	1%	0.3%	0.1%	0.1%

Source: USGS 2009c

Alameda Creek Downstream of the ACDD

Alameda Creek downstream of the ACDD has two distinct reaches: the reach from ACDD to the Calaveras Creek confluence and the Sunol Valley Reach (from the Calaveras Creek confluence to the Arroyo de la Laguna confluence).

As shown in Figure 4.6.2, major tributaries include Calaveras Creek, which conveys spills and releases from Calaveras Reservoir; Welch Creek, which flows into Alameda Creek near the SVWTP; San Antonio Creek, which conveys releases from San Antonio Reservoir; and Arroyo de la Laguna, which conveys flows from the northern hydrologic sub-area.

Streamflows in Alameda Creek downstream of the ACDD are substantially influenced by operation of the ACDD, Calaveras Reservoir, and San Antonio Reservoir and include inflow from the watershed downstream of the dams. In general, flows are highest during the winter and spring rainy season and much lower in summer and early fall; however, flows are also largely dependent on operation of the reservoirs. Local runoff quantities downstream of the ACDD, Calaveras Dam, and Turner Dam have been estimated to average 4,500 AFY (Bookman-Edmondston 1995).

ACDD to Calaveras Creek Confluence

The reach of Alameda Creek from the ACDD to the Calaveras Creek confluence is downstream of the ACDD and is characterized by stream gradients ranging from 15 percent in the Little Yosemite Reach to lower gradients of 2 to 4 percent immediately downstream of the ACDD. Alameda Creek from the ACDD to Calaveras Creek is 2.8 miles long with an average slope of 191 feet per mile. Alameda Creek flows in the baseline period have been controlled in 3 out of 8 water years by diversions to Calaveras Reservoir (see Figure 4.6.10: Unimpaired Inflow, Diversions, and Calculated Spill at ACDD, Water Years 1998-2009, presented later in this section under “ACDD Baseline Operation (DSOD Restriction).”). Currently, due to the DSOD operating restriction, less flow is diverted from Alameda Creek to Calaveras Reservoir and more water from the upper watershed flows past the ACDD and into this reach than during pre-DSOD restriction operations. In Section 4.5, Fisheries and Aquatic Habitat, this segment of the creek is designated as Reaches A-3 and A-4 (see Figure 4.5.1).

As shown in Table 4.6.13 (presented in “Operation of ACDD,” later in this section), unimpaired flows upstream of the ACDD in Alameda Creek dwindle to almost nothing during the summer. Flow in Alameda Creek at the ACDD has been altered during high flow periods in the winter and spring in half of the years of the baseline condition, but the diversions are less than those made under dam operations before the DSOD restriction. Unimpaired flows in summer and fall on average dwindle to less than 2 cfs from July to October (see Table 4.6.5) and were generally bypassed under pre-DSOD operations and continued to be bypassed under current DSOD-restricted operating conditions. Bypass flows pass over the ACDD into this reach of Alameda Creek.

Operation of the ACDD is discussed further below under “Water Bodies and System Operations.”

Sunol Valley Reach

The reach of Alameda Creek downstream of the Calaveras Creek confluence through the Sunol Valley has a low gradient, with an elevation change of about 16 feet per mile. In Section 4.5, Fisheries and Aquatic Habitat, this segment of the creek is designated as Reaches A-1 and A-2 (see Figure 4.5.1).

Alameda Creek from its confluence with Calaveras Creek down to the Arroyo de la Laguna confluence is approximately 8 miles long. The creek channel is wide and braided in places; long sections have very shallow depths of water under low-flow regimes. Mining activities are present in this reach. For example, Cemex mining operations are located on the right bank of Alameda Creek upstream of the San Antonio Creek confluence. In the lower reaches of the Sunol Valley, Alameda Creek is heavily influenced by gravel mining activities, including relocation of the channel in some locations, and a substantive portion of surface flow is lost to groundwater (ENTRIX 2006, pp. 15–20).

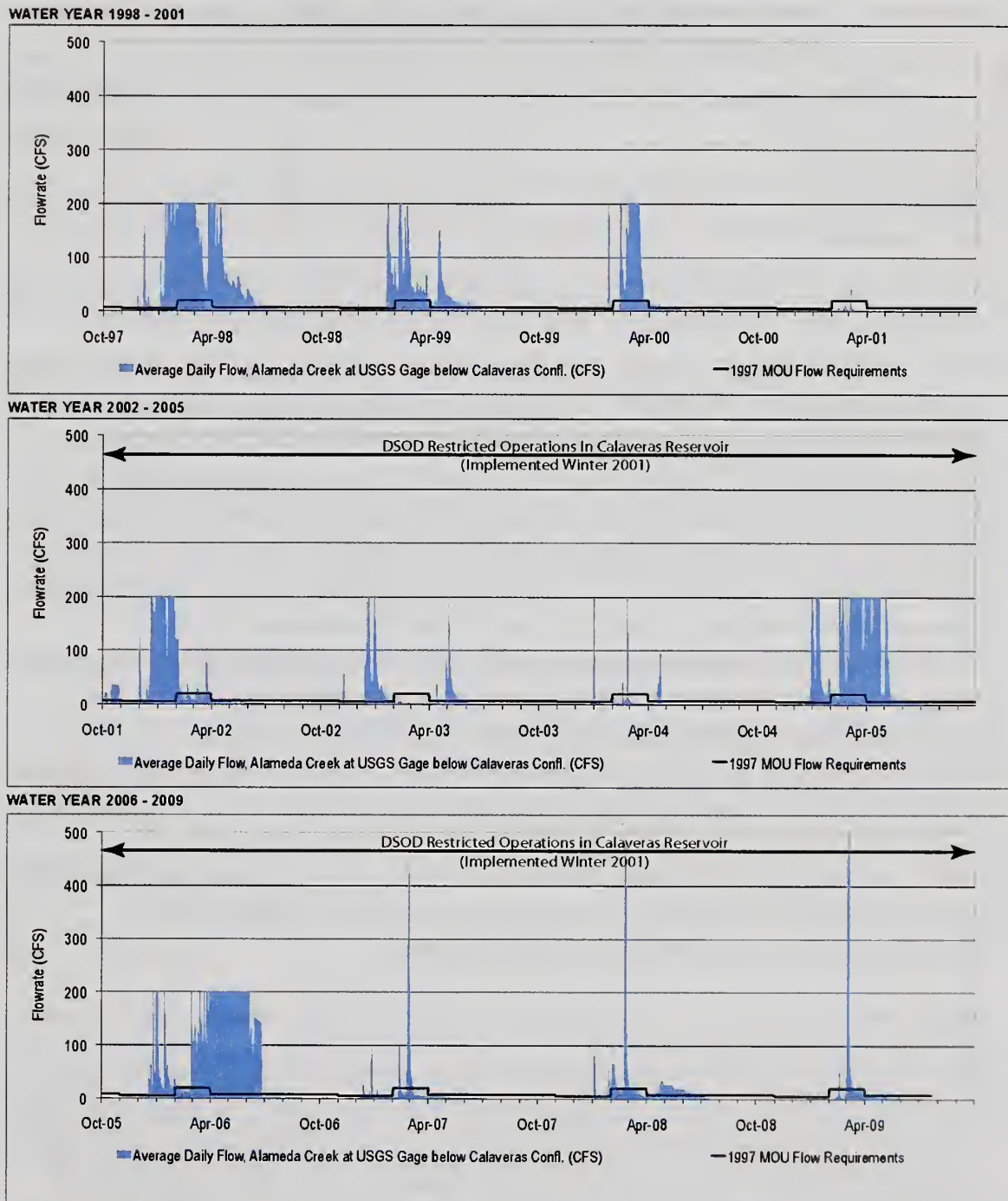
Memorandum of Understanding (MOU) with California Department of Fish and Game

In 1997, the SFPUC and the California Department of Fish and Game (CDFG) signed an MOU regarding water releases from Calaveras Reservoir and minimum storage levels from July through October to enhance fishery habitat, improve the cold-water fishery resource downstream of Calaveras Dam, and enhance warm-water fisheries in the lower reach of Alameda Creek (CDFG 1997) (see Appendix H for a copy of the MOU). The basis for these flows is a study conducted by Bookman-Edmondston in 1995 (Bookman-Edmondston 1995, p. 18). The measuring point (i.e., point of compliance) for these flow requirements is Alameda Creek immediately downstream of the confluence of Calaveras Creek.

The MOU requires the SFPUC to maintain specified base flows in Alameda Creek (immediately downstream of the confluence with Calaveras Creek) year round; however, releases from Calaveras Dam to maintain these flows have not yet been implemented, as discussed below.

The 1997 MOU was meant to provide for Alameda Creek flows in the reaches downstream of the confluence with Calaveras Creek throughout most months, most notably in the dry summer months. During higher flows in winter months, releases are not likely to be needed on a daily basis because Alameda Creek frequently has sufficient base flow to satisfy the agreement (see Figure 4.6.6: Average Daily Flow in Alameda Creek Downstream of the Calaveras Creek Confluence, Water Years 1998–2009).

Figure 4.6.6: Average Daily Flow in Alameda Creek Downstream of the Calaveras Creek Confluence, Water Years 1998–2009



Note: October 1995 to September 2006 low flow records only (<200 cfs). October 2006 to present, full flowrate gaged.

Sources: USGS 2009d, CDFG 1997

The flow requirements of the 1997 MOU are shown in Table 4.6.6.

Table 4.6.6: Flows Required Immediately Downstream of the Confluence of Alameda and Calaveras Creeks by the CDFG 1997 MOU

Period	5-Day Running Average (cfs)	Minimum Daily (cfs)
November 1 – January 14	5	4.5
January 15 – March 15	20	18
March 16 – October 31	7	6.3

Source: CDFG 1997

The SFPUC has not implemented the water releases because of the current limitations in storage ordered by the DSOD, and because the MOU was premised on the construction of a flow recapture facility to redirect flows released from storage or bypassed at ACDD. As part of the Calaveras Dam replacement, the SFPUC proposes to implement releases in the proposed bypass at the ACDD and from Calaveras Dam at quantities to maintain the 1997 MOU target flows (SFPUC 2005b). In the 1997 MOU, the SFPUC agreed to use best efforts to maintain at least 30,000 AF (corresponding to a reservoir elevation of 690 feet) in Calaveras Reservoir, as well as to release up to 6,300 AF annually from the reservoir for compliance with the 1997 MOU. The SFPUC has wholly incorporated the MOU flow requirements into the proposed project, without the associated recapture facility, which is planned for another separate project that is in preliminary design and currently referred to as the Upper Alameda Creek Filter Gallery Project. Although construction of the recapture facility is not part of the proposed Calaveras Dam replacement project, the recapture facility is part of the Water System Improvement Program (WSIP) as approved by the SFPUC, and the combined impacts of the recapture facility project and the Calaveras Dam replacement project are addressed in Section 6.2, Cumulative Impacts.

Further detail on the 1997 MOU and releases from Calaveras Reservoir is provided later in this section under “Water Bodies and System Operations,” as well as in Chapter 3, Project Description, and Section 4.5, Fisheries and Aquatic Habitat.

Gaged Flow

Two USGS gages are located within the Sunol Reach of Alameda Creek. Operations of the ACDD and Calaveras Reservoir are reflected in data from these gages. The gages are located on Alameda Creek downstream of the confluence with Calaveras Creek and downstream of the confluence with Welch Creek. However, data from these gages are of limited utility due to incomplete records.

Alameda Creek Downstream of the Calaveras Creek Confluence: The gage downstream of Calaveras Creek (11173510) was a low flow gage (only recorded data for flows less than 200 cfs) through 2006. The period of record for this gage is from Water Year 1997 to

present. Figure 4.6.6: Average Daily Flow in Alameda Creek Downstream of the Calaveras Creek Confluence, Water Years 1998–2009, presents daily flow at this gage from Water Year 1997 to Water Year 2009. Also displayed on the figure are the MOU flow requirements. MOU flow requirements are displayed to contrast recent past operation with future requirements. The scale has been adjusted on the chart to illustrate periods of low flow and the MOU flow requirements.

Alameda Creek Downstream of the Welch Creek Confluence: The gage downstream of Welch Creek has been operational since October 1999 and largely reflects operation of Calaveras Reservoir under the DSOD restriction for reduced storage in Calaveras Reservoir. The data for both gages are also influenced by tributary inflow and runoff between the gages.

Table 4.6.7 provides a summary of monthly data from the Welch Creek gage. Figure 4.6.7: Average Daily Flow in Alameda Creek Downstream of the Welch Creek Confluence, Water Years 1998–2009, shows daily flow at the gage, as well as pre-DSOD restriction daily reservoir levels. Periods of high flow at the gage correspond with both filling and releasing at the dam. Other periods of steeply dropping water surface elevation without flow spikes in Alameda Creek indicate diversions for water supply and, to a much lesser degree, evaporation from Calaveras Reservoir.

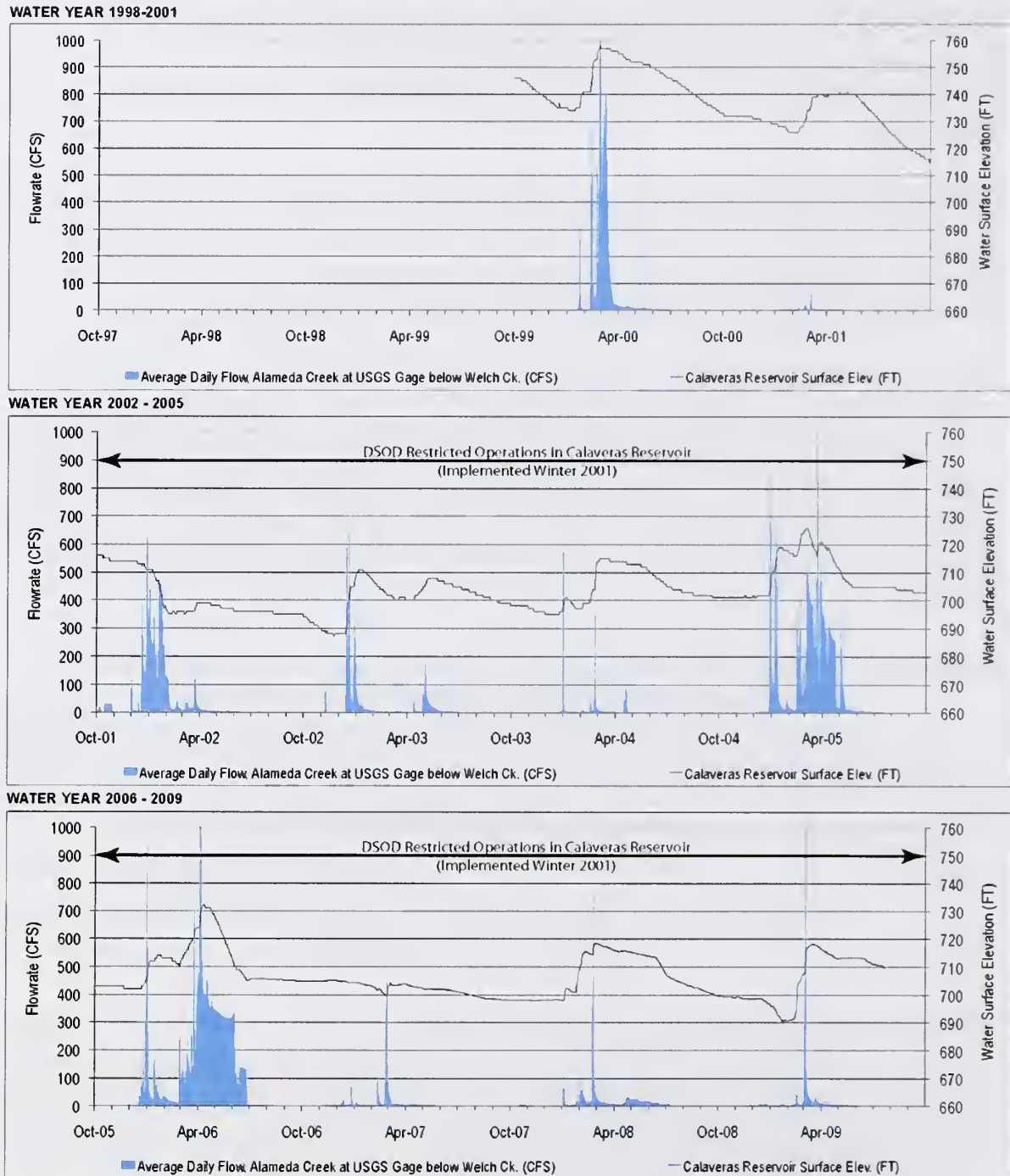
Table 4.6.7: Monthly Flow in Alameda Creek Downstream of the Welch Creek Confluence, Water Years 2000–2009 (cubic feet per second)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	2.4	1.4	39	62	56	99	85	50	18	1.2	0.4	0.2
Max Daily Avg	34	83	926	699	1,040	1070	1340	345	335	7.3	1.6	1.6
Min Daily Avg	0.0	0.0	0.1	0.9	1.4	2.0	1.4	0.6	0.2	0.1	0.0	0.0
% of Av. Annual Flow	0.6%	0.3%	9%	15%	14%	24%	21%	12%	4%	0.3%	0.1%	0.1%

Source: USGS 2009e

Alameda Creek Downstream of the Sunol Valley: As Alameda Creek exits the Sunol Valley, it is joined from the north by Arroyo de la Laguna, which conveys flow from the northern portion of the Alameda Creek hydrologic sub-area, and flows into the Niles Canyon Reach. After exiting Niles Canyon, Alameda Creek is contained within a levee bordered flood control channel for approximately 11 miles until it reaches San Francisco Bay. A number of grade control and diversion structures exist on Alameda Creek. The grade control structures serve to limit erosion of in-stream structures as well as to divert flow for ACWD water supply. These structures are discussed in detail in Section 4.5, Fisheries and Aquatic Habitat.

Figure 4.6.7: Average Daily Flow in Alameda Creek Downstream of the Welch Creek Confluence, Water Years 1998–2009



Note: Welch Creek Gage began operation in October 1999.

Sources: USGS 2009e; daily reservoir data provided by SFPUC 2009

Flow in lower Alameda Creek is measured by two USGS gages near the downstream end of Niles Canyon and within the flood control channel, near the Interstate 880 (I-880) overcrossing. These gages record flows from the Sunol Valley (Alameda Creek) and the Livermore Valley (Arroyo de la Laguna, Arroyo Mocho, and Arroyo Del Valle), as well as releases made into the creek from the State Water Project on Vallecitos Creek and inflow from the Niles Canyon watershed. Recent flow data from the Niles gage is presented below to illustrate the range of flows in lower Alameda Creek. The Niles gage has been in operation since 1891; however, the data presented in Table 4.6.8 and Figure 4.6.8: Average Daily Flow in Alameda Creek near the Downstream End of Niles Canyon, Water Years 1998–2009, present flow data at this location to illustrate flows under recent operation of water control facilities in the upper watersheds. Table 4.6.8 includes an analysis of data from Water Year 1980 to Water Year 2006 and Figure 4.6.8 presents a shorter timeline, Water Years 1998–2009, to illustrate the seasonality and variability of flow in the creek. Similar to the creeks in the upper watersheds, flow at Niles is flashy, with large peaks in response to rainfall in winter months and much lower flow in summer months.

Table 4.6.8: Monthly Flow in Alameda Creek near the Downstream End of Niles Canyon, Water Years 1980-2009 (cubic feet per second)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	34	62	135	324	533	395	170	72	45	40	38	34
Max Daily	865	1,610	4,600	6,630	9,770	9,430	4,980	1,860	340	89	112	152
Min Daily	0.63	2.1	7.7	8.4	12	13	5.7	6.6	2.3	1.4	2.2	0.7
% of Average Annual Flow	1.8%	3.3%	7.2%	17%	28%	21%	9.0%	3.8%	2.4%	2.1%	2.0%	1.8%

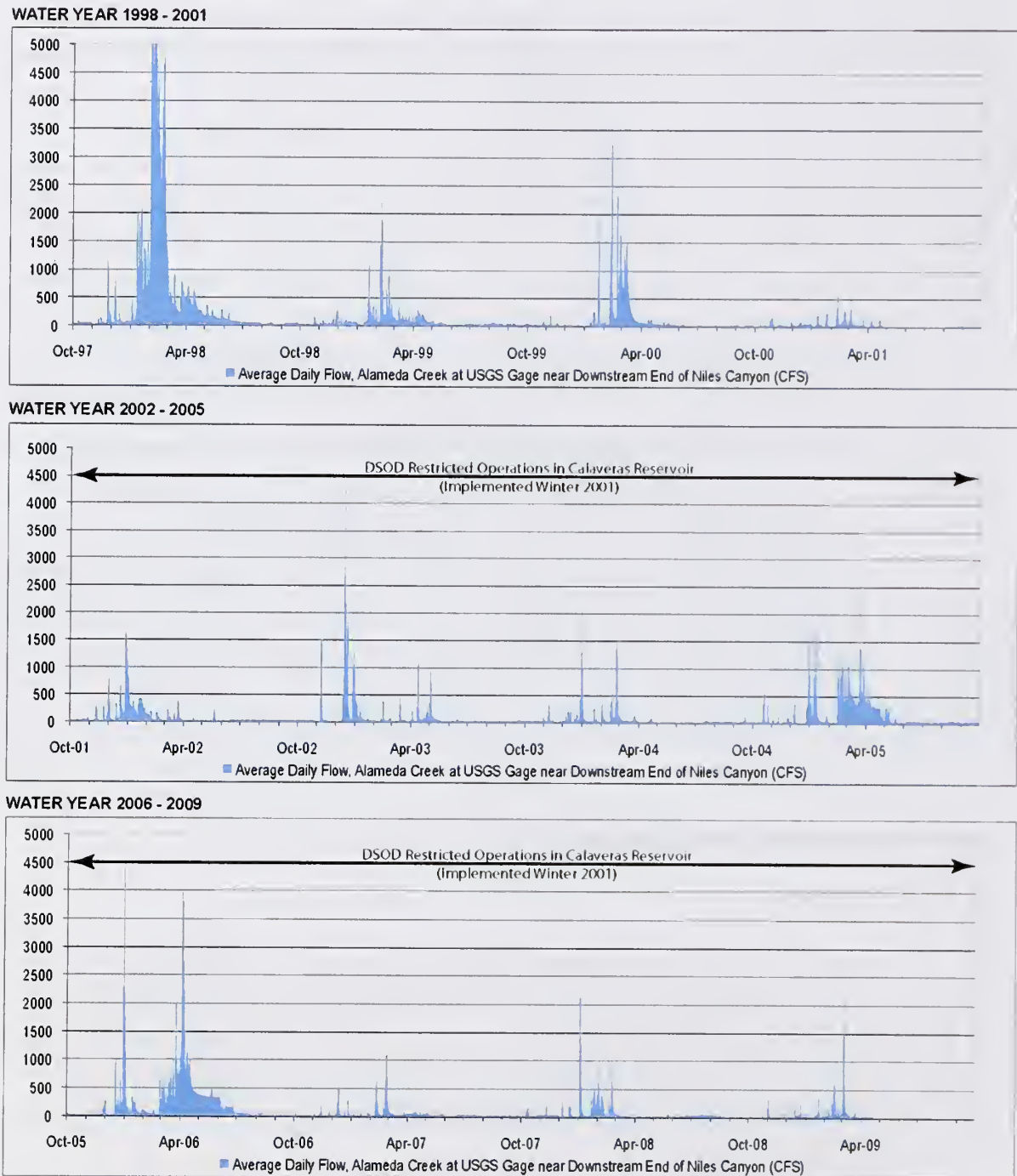
Source: USGS 2009f

Water Bodies and System Operations

Calaveras Reservoir

Calaveras Reservoir, located at the southern end of the Alameda Creek watershed, collects and stores water from the local watershed only and includes the Arroyo Hondo and Calaveras Creek sub-watersheds with a total area of approximately 98 square miles. Table 4.6.9 provides monthly statistics for inflow to Calaveras Reservoir from the drainage. Note in the table the range of winter inflow to Calaveras Reservoir, from 25,200 AF in February of wet years to 1,530 AF in February of dry years.

Figure 4.6.8: Average Daily Flow in Alameda Creek near the Downstream End of Niles Canyon, Water Years 1998–2009



Source: USGS 2009f

Table 4.6.9: Monthly Unimpaired Inflow to Calaveras Reservoir from Calaveras Creek and Arroyo Hondo, Water Years 1921–2002 (acre-feet)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
W	78	1,060	7,264	21,016	25,200	18,096	10,859	2,942	659	299	152	105	87,730
AN	104	1,166	5,265	11,681	15,431	10,185	5,701	1,624	467	198	105	76	52,003
N	82	500	4,563	5,435	7,968	6,019	2,778	976	267	100	58	43	28,789
BN	90	484	1,502	3,110	4,868	3,813	1,177	716	195	68	42	32	16,097
D	82	191	637	896	1,530	1,082	679	355	108	43	29	26	5,658
All	87	684	3,835	8,402	10,979	7,819	4,219	1,319	339	141	77	56	37,957
<i>Notes:</i> W = Wet, AN = Above-normal, N = Normal, BN = Below-normal, D = Dry.													

Source: SFPUC 2009

Data in Table 4.6.9 were developed for the SFPUC operations model, Hetch Hetchy/Local Simulation Model (HH/LSM).³ The data in the table represent 82 years of actual and synthesized hydrology, interpolated from nearby watersheds to extend the record and incorporate a large range of hydrologic year types. Data developed for the HH/LSM are on a monthly time step and do not provide detail on daily hydrology; however, the data are useful for long-term trends and monthly averages. The year types provided in the table correspond to a ranking of the 82 years of hydrology into 20th percentiles, labeled as wet, above-normal, normal, below-normal, and dry.

Water from an additional 34 square miles that drains into Alameda Creek upstream of the ACDD can be diverted to Calaveras Reservoir through a 1.8-mile diversion tunnel with an approximate capacity of 650 cfs. Thus, the total drainage area supplying Calaveras Reservoir is approximately 132 square miles.

Calaveras Reservoir Operation

Calaveras Reservoir was constructed with a storage capacity of approximately 96,850 AF. Since the reservoir began operation in 1925, sediment deposited in the reservoir has reduced the capacity by approximately 4,850 AF. Unlike other local reservoirs in the water supply system that are filled in part from Sierra Nevada sources, the sole source of Calaveras Reservoir is local water from the Calaveras Creek, Arroyo Hondo, and Alameda Creek watersheds. If the Hetch Hetchy supply is temporarily suspended or is diverted (e.g., for maintenance activities), water from Calaveras Reservoir and other local reservoirs is used to meet demand. Calaveras Reservoir also provides operational flexibility for the Hetch Hetchy system in late summer and fall, when Hetch Hetchy is refilling, and during drought periods.

³ HH/LSM is further discussed in 4.6.2.2 Approach to Analysis and in Appendices D1 and D2.

As described in Subsection 3.2.2.3, Seismic Safety and Reliability, in Chapter 3, Project Description, in 2001, DSOD performed an evaluation of Calaveras Dam and concluded that the dam is not seismically stable at normal operating levels due to properties of the soil material used in dam construction (DSOD 2001, 2003; Olivia Chen Consultants 2003). The DSOD restrictions reduced the total storage capacity of the reservoir by approximately 60 percent, a reduction in gross storage of over 58,000 AF (see Table 4.6.10). During calendar years 2002 to mid-2006, daily storage levels in Calaveras Reservoir ranged from a low of approximately 24,000 AF in November 2002 to about 66,000 AF in April 2006 (daily reservoir data provided by SFPUC 2008).

Table 4.6.10: Storage in Calaveras Reservoir

	Storage in Calaveras Reservoir (acre-feet)	Reservoir Elevation (feet)
Pre-DSOD Restriction Maximum Operating Conditions	96,850	756
Interim Conditions (2001 DSOD Restriction)	38,100	705
Minimum Water Surface Elevation Target (1991 CDFG MOU)	25,700	690

Source: URS. 2005b, pp. ES-3, 2-1, and B-3

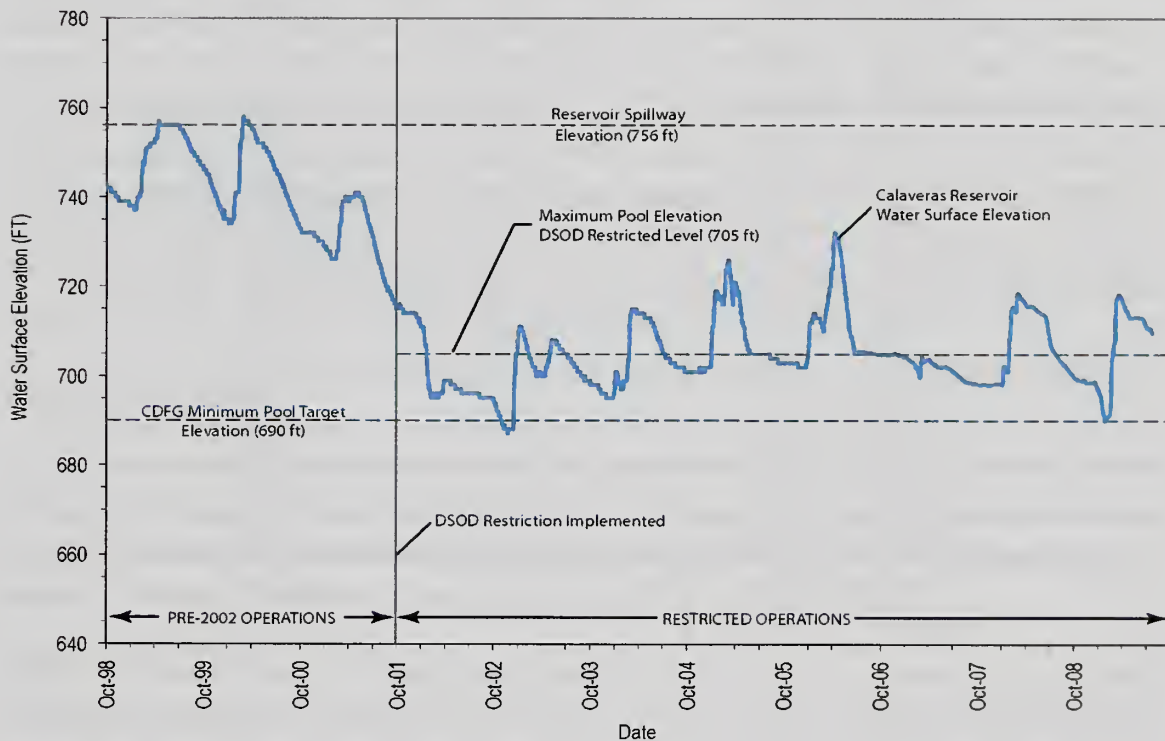
As stated previously, due to the DSOD restriction, the Calaveras Reservoir system under baseline conditions is periodically diverting flow from Alameda Creek via the ACDD but with less frequency and flow than during the time when Calaveras Reservoir historically was fully operational. In addition, in 1991, the SFPUC and CDFG agreed on a desired minimum operating level of Calaveras Reservoir of Elevation 690 feet to protect juvenile fish populations. This equates to approximately 25,700 AF of storage (not including sediment). When this CDFG restriction is considered in combination with the current DSOD restriction on the maximum operating elevation of Calaveras Reservoir, the reservoir level fluctuates generally between the current maximum permitted elevation of 705 feet and the minimum elevation of about 690 feet.

Calaveras Reservoir is allowed to exceed the elevation of 705 feet following periods of heavy inflow. At such times, the SFPUC employs “best faith efforts” to lower the reservoir level by releasing water to the regional system, and, if necessary, discharging excess inflow to Calaveras Creek via the cone valve (and spillway if necessary). Calaveras Reservoir storage operations are typically seasonally cyclical: the reservoir fills in the late winter/early spring and is depleted during the summer by withdrawals to provide raw water to the SVWTP. Historically before December 2001, Calaveras Reservoir would normally be allowed to fill by the end of the rainy season in normal or wet years. The reservoir would be drawn down 15,000 to 20,000 AF by early winter to ensure sufficient capacity to capture winter runoff. During a drought or water supply emergency, the reservoir would be further drawn down to meet SFPUC water supply needs. During a drought, reservoir storage is depleted by the slow, successive drawdown of reservoir storage due to required releases and drafting to the SVWTP that exceeds watershed runoff. The

reservoir then refills subsequent to drought, as the SFPUC strives to conserve local watershed runoff. Under DSOD restrictions these cyclical operations continue as before, but the amount of water stored in the reservoir and directed to the SVWTP is substantially reduced.

Daily water surface elevations in Calaveras Reservoir are presented in Figure 4.6.9: Daily Water Surface Elevations in Calaveras Reservoir, Water Years 1998–2009. The transition from normal operation to DSOD-restricted water level is notable in Water Year 2001 when the reservoir pool high elevation dropped to the permitted level.

Figure 4.6.9: Daily Water Surface Elevations in Calaveras Reservoir, Water Years 1998–2009



Source: Daily reservoir data provided by SFPUC 2009

Releases from Calaveras Reservoir

As part of system operations, the SFPUC can make releases from Calaveras Reservoir to Calaveras Creek, which then flow to Alameda Creek. Controlled emergency releases and releases for experimental purposes (i.e., for fish studies) are made through the dam outlet works, which can release up to approximately 1000 cfs. Uncontrolled spills are conveyed to Calaveras Creek through the spillway structure. Under pre-DSOD restricted conditions when Calaveras Reservoir was filled to an elevation near the top of Calaveras Dam, the spillway had the capacity to discharge in excess of 33,000 cfs.

Calaveras Dam spilled infrequently prior to the DSOD restrictions. Recorded spills since 1938 have occurred in the following water years: 1941, 1945, 1952, 1956, 1958, 1965, 1967, 1969, and 1996–2000, as shown in Table 4.6.11. The highest recorded flow in the spillway was 5,800 cfs on April 3, 1958.

Table 4.6.11: Pre-DSOD Restriction Calaveras Reservoir Spillway Releases

Date	Average Daily Spill (cfs)
02/18/41 – 03/21/41	438
03/30/41 – 04/21/41	518
04/09/45 – 05/05/45	137
01/11/52 – 02/20/52	634
02/28/52 – 03/06/52	49
03/08/52 – 04/09/52	379
04/27/52 – 05/26/52	128
01/18/56 – 02/09/56	515
02/23/56 – 05/06/56	254
03/17/58 – 05/29/58	574
04/12/65 – 05/08/65	431
04/03/67 – 05/15/67	540
02/25/69 – 05/15/69	378
01/28/96 – 04/30/96	506
01/03/97 – 02/22/97	592
02/06/98 – 06/17/98	439
04/13/99 – 07/02/99	31
02/24/00 – 03/30/00	497
<i>Note:</i> cfs = cubic feet per second.	

Source: Data provided by SFPUC 2008

It has not been necessary to use the spillway since the DSOD restriction on reservoir storage was mandated in 2001. Following periods of heavy inflow, reservoir storage rises temporarily while the SFPUC attempts to lower the level by releasing water to the SVWTP and occasionally discharging water through the cone valve to the lower spillway and stilling basin and from there to Calaveras Creek. This type of discharge occurred from March to June 2006. Releases through the cone valve since DSOD restrictions were implemented are summarized in Table 4.6.12.

Table 4.6.12: Approximate Calaveras Dam Cone Valve Releases

Dates	Total Release (AF)
12/2001 – 02/2002	30,000
03/2005 – 05/2005	27,000
03/2006 – 06/23/2006	45,000
<i>Notes:</i> cfs = cubic feet per second, AF = acre-feet. Variations in the identified release rates have occurred within these time periods.	

Sources: Data provided by SFPUC 2009; USGS 2009b

Water from Calaveras Reservoir can be diverted to the SVWTP at a rate up to the capacity of the Calaveras Pipeline (90 million gallons per day [mgd]). Water can also be transferred to San Antonio Reservoir if storage capacity is available. Water is conveyed from the dam through a 4.1-mile-long pipeline that delivers flows to the SVWTP. Annual water supply deliveries from Calaveras Reservoir to the SVWTP have ranged from 9,853 AF to 33,216 AF, and transfers from Calaveras Reservoir to San Antonio Reservoir have ranged from 18 AF to 9,786 AF in recent years (2002 to 2005). Water flows from Calaveras Reservoir to the SVWTP by gravity. After SVWTP treats the water, it enters the Hetch Hetchy Aqueduct via Alameda Siphon No. 2 and is conveyed to customers or to Crystal Springs Reservoir.

Operation of ACDD

The ACDD and diversion tunnel to Calaveras Reservoir were constructed between 1925 and 1931 to increase the reservoir's water supply. The structure consists of a concrete dam approximately 30 feet high with a crest elevation of approximately 919 feet (NGVD29). The impoundment created by the dam is estimated to store approximately 18.4 AF (WRE 2000).

Within the impoundment is a channel which flows to the entrance of the diversion tunnel. Two 5-foot-wide-by-8-foot-high gates control flow into the tunnel. These gates are operated manually; there is no electrical power at the ACDD site. The diversion capacity of the diversion tunnel is a nominal 650 cfs. When the diversion gates are open, the ACDD diverts all flow in Alameda Creek up to the capacity of the diversion tunnel. When flow in the creek exceeds the capacity of the diversion tunnel, it pools behind the dam and eventually overtops the dam and flows down Alameda Creek. A review of daily flow rates from the ACDD gage indicates that the flow rate in Alameda Creek infrequently exceeds the capacity of the diversion tunnel.

Sluicing is the procedure of washing accumulated sediments from behind a dam into downstream watercourses. Sediment transport helps maintain streambed habitat downstream of the dam and prevents sediments from accumulating at and upstream of the dam at an excessive level. Within the ACDD there are sluice gates allowing for flow through the dam. Normal operating position for the sluice gates is closed. When opened, the sluice gates allow flow to pass through the

ACDD and wash out accumulated sediment. Sluicing is, in general, conducted on an annual basis at ACDD, normally in February. Sluice gates in the dam are opened for 48 hours to flush sediment from the upstream side of the dam. When the gates are opened, water velocities in the sluice tunnel are approximately 50 cfs. Approximately 900 cubic yards (operator estimate) of sediments are flushed downstream. The sluice gates reportedly must be either fully open or fully closed to maintain the integrity of the gates. Anecdotal evidence indicates that the gates leak and that there is a minor amount of through flow, amounting to approximately 1 cfs. No low-flow method of bypassing flow through the ACDD exists at this time. The sluicing procedure allows sediments to be transported through Alameda Creek downstream of the ACDD.

Flow is not metered through the diversion tunnel or in Alameda Creek downstream of ACDD until it reaches the confluence with Calaveras Creek. The only flow monitoring in this reach is from the USGS gage approximately 700 feet upstream of the ACDD, which has been in operation since October 1994. Historical hydrology was also developed by the SFPUC for the period of Water Years 1921-2002 and reflects a mixture of metered and synthesized flow. Table 4.6.13 presents average monthly inflow statistics for ACDD based on the SFPUC hydrologic data. The data indicate that average annual streamflow in Alameda Creek at the ACDD is approximately 12,879 AF per year, ranging from 1,880 AF in dry years to 29,307 AF in wet years.

Table 4.6.13: Modeled Average Monthly Unimpaired Flow to ACDD, Water Years 1921–2002 (acre-feet)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year Total
W	7	156	2,472	7,382	8,284	6,064	3,608	1,035	227	42	18	12	29,307
AN	18	183	1,817	4,394	5,619	3,692	1,976	542	139	23	11	7	18,421
N	7	41	1,589	1,840	2,685	2,029	939	332	87	8	5	3	9,565
BN	7	42	554	1,069	1,689	1,271	395	246	64	6	4	3	5,350
D	7	16	222	314	531	382	238	124	38	3	3	2	1,880
All	9	88	1,327	2,993	3,759	2,683	1,425	454	111	17	8	5	12,879

Notes:
W = Wet, AN = Above-normal, N = Normal, BN = Below-normal, D = Dry.

Source: SFPUC 2009

Pre-DSOD Operation of the ACDD

When the ACDD and diversion tunnel historically were in use, flow from upper Alameda Creek was diverted at the beginning of the rainy season (mid-October) to Calaveras Reservoir via the diversion tunnel. Diversion continued until the end of the rainy season (March/April). The diversion gates were closed earlier depending on the weather forecast, rate of inflow from Arroyo Hondo and Calaveras Creek into Calaveras Reservoir, rate of rise in Calaveras Reservoir water level, and the rate of outflow via the Calaveras Pipeline to SVWTP.

Prior to DSOD restrictions, during diversion to Calaveras Reservoir, all inflow up to the capacity of the diversion tunnel (approximately 650 cfs) was diverted to Calaveras Reservoir and relatively little water flowed in Alameda Creek downstream of the ACDD. The SFPUC has estimated, using the HH/LSM model, that prior to DSOD-restricted reservoir levels, about 8,000 AFY on average had been diverted from Alameda Creek to Calaveras Reservoir in years with normal rainfall. Sluicing of sediments that built up behind the ACDD occurred on an annual basis, as described above. Following completion of a sluicing procedure, there were no bypassing flows through the sluicing gates.

ACDD Baseline Operation (DSOD Restriction)

Diversions from Alameda Creek during the baseline period have been more intermittent than during historical operations. The SFPUC began implementing the DSOD restriction in Water Year 2002, which means that it discontinued operating Calaveras Reservoir at its full historical capacity in the autumn of 2001. Due to hydrological/meteorological conditions, diversions from Alameda Creek to Calaveras Reservoir continued in 2002, partially in 2003, and again in 2004. Diversions did not occur in 2005 or 2006, both above-normal hydrologic years when Calaveras Reservoir fill limits were met entirely from reservoir watershed flows; diversions were initiated again in 2007, a dry year, and early in 2008 (see Figure 4.6.10, Average Daily Unimpaired Inflow, Diversions, and Spills at ACDD, Water Years 2002–2009).

The variable operation of diversions has resulted in more flow in Alameda Creek downstream of the diversion dam in the baseline period as compared to the unrestricted pre-DSOD condition. Despite the intermittent operation of the diversion dam, sluicing has occurred on an annual basis except for 2002.

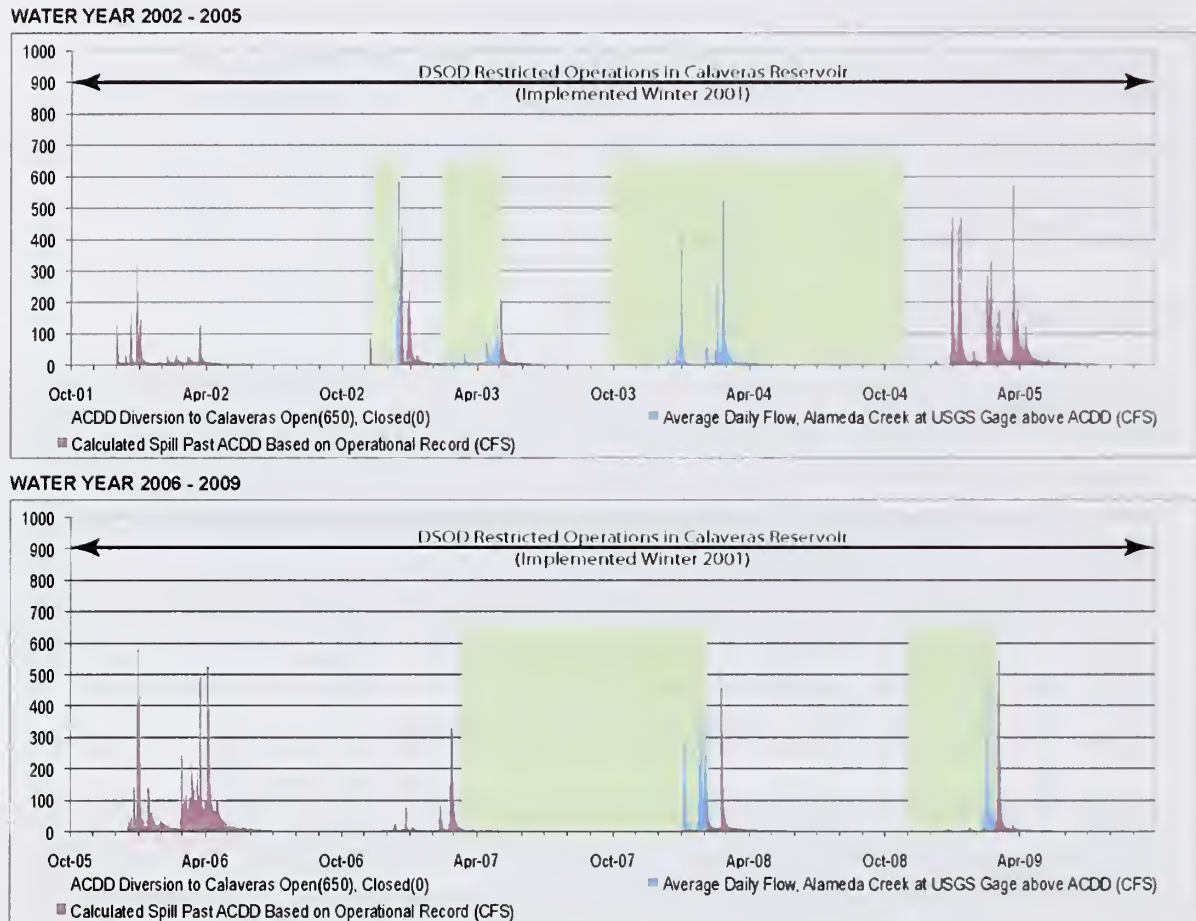
Use of the diversion tunnel during the baseline is shown in Table 4.6.14.

Table 4.6.14: Recent Operation of the Alameda Creek Diversion to Calaveras Reservoir

Date Opened	Date Closed
11/13/02	12/18/02
2/13/03	5/02/03
9/29/03	10/24/04
3/13/07	2/05/08
11/03/08	2/27/09

Source: SFPUC unpublished data

Figure 4.6.10: Average Daily Unimpaired Inflow, Diversions, and Calculated Spill at ACDD, Water Years 2002–2009 (cubic feet per second)



Note: Diversion records not available prior to November 2000.

Source: USGS 2009c, data provided by SFPUC 2009

Figure 4.6.10 plots average daily flow at the ACDD gage over the period 2002-2009 (shown in blue). Past operation of the ACDD under DSOD restriction has also been charted by presenting estimates of spill past the ACDD (shown in maroon). Periods when the diversion gates were open (diverting water to Calaveras Reservoir) are shown as blocks of light green behind the charts. In 2005 and 2006, almost all flow in Alameda Creek bypassed ACDD and continued down Alameda Creek. The 2005 and 2006 water years were above-normal rainfall years, and under the DSOD operating restriction, additional diversion to Calaveras Reservoir was not warranted because the reservoir was already operating at or above the Elevation 705-foot restriction.

Flooding Hazards

Calaveras Reservoir has no primary flood control function; however, free capacity in the reservoir does provide incidental flood protection. Because of DSOD pool elevation restrictions, the reservoir has a very large capacity to store waters briefly during and following large storm events. That “extra” storage capacity reduces flood hazards downstream in Calaveras Creek and Alameda Creek because release of the waters can be delayed until after the peak storm flow has passed in the watershed. DSOD allows the reservoir level to rise above Elevation 705 feet but requires that the SFPUC exercise its best faith effort to draw down the reservoir rapidly. The rapid drawdown is achieved by withdrawals to the SVWTP and cone valve releases. During the large storms in spring 2006, such actions were undertaken to reduce the reservoir level. The cone valve release flows at the dam were carried out during the period in which high flows were occurring in all creeks in the watershed and continued for several months (see Table 4.6.12, Approximate Calaveras Dam Cone Valve Releases).

Under existing conditions, if a rainstorm is of short duration and a release must be made, then a cone valve release from the reservoir often can occur somewhat later than the peak runoff in the Alameda Creek stream system. This release timing is related to the lag time needed to fill the reservoir to the level at which releases would be required and largely depends on the reservoir level at the time stormwater inflow is initiated. By the time the reservoir reaches the elevation requiring a release, the peak flows of a storm in the watershed already may be past. In such an event, the cone valve release from Calaveras Reservoir would attenuate the peak flow or high-flow period downstream in Alameda Creek, or it would occur during declining flow in the stream system, thereby ameliorating any potential downstream flooding hazard. In either situation, the “extra” storage capacity of Calaveras Reservoir has a beneficial effect on downstream flood hazard.

In an alternative storm condition in which the storm extends over several days or occurs when the reservoir pool is already at Elevation 705 feet, because of the brief time required for inflow to fill the reservoir to an elevation requiring drawdown, the cone valve release could occur

coincidentally with peak flows in the Alameda Creek stream system. This is because the lag time needed to fill the reservoir and initiate a cone valve release would “catch up” to the rising curve of flow from the watershed as a whole (upper Alameda Creek, Welch Creek, and other tributaries) in a storm event. If the reservoir level is already high, then a release via the cone valve would have to occur soon after inflow is initiated. Although not as beneficial in effect as the short storm condition, the latter situation would still create a beneficial effect because it would reduce the overall “relative” downstream peak flow. This is because the cone valve has an upper limit of 700 cfs for release. Thus, water continues to fill the reservoir while release occurs, thereby creating a lag in the discharge. In that situation, release flows would extend the period of high flows, but by no more than the time it would take to draw down the reservoir to the required pool level.

As noted in Section 3.4.1, Design Criteria, in Chapter 3, Project Description, the projected probable maximum flood event is based on a probable maximum precipitation (PMP) event of 30.8 inches of rainfall in a 72-hour period that generates a flow over the spillway of 49,521 cfs. Such a flood has not occurred to date at Calaveras Reservoir. As noted, the highest recorded flow in the spillway was 5,800 cfs on April 3, 1958.

The ACFCWCD was created in 1949. In 1957, Zone 7 of the district was formed for the Alameda Creek watershed, which extends upstream of Niles Canyon and includes the Arroyo de la Laguna and the northern Alameda Creek hydrologic sub-area. In response to repeated flooding, the ACFCWCD constructed an 11.1-mile flood control channel that regulates flood flows in Alameda Creek and conveys them to San Francisco Bay, downstream of Niles Canyon. The channel begins about 1.5 miles downstream of the former Niles Dam site. Sediment is regularly removed from several miles of the flood control channel.

Historical flooding has occurred in Alameda Creek, with the largest flood in recent history occurring in 1958 (West Yost and Associates 2002). Flood damage surveys were conducted subsequent to the floods of 1950, 1952, 1955, and 1958. Surveys were not conducted for the floods of 1963, 1967, and subsequent floods due to their relatively small size and apparent lack of damage (USACE 1985:24). The City of Fremont has not flooded since construction of the large flood control channel on lower Alameda Creek in 1972.

Prior to DSOD-restricted reservoir operations, Calaveras Dam has spilled when the water surface elevation exceeded 756 feet. Flooding may occur downstream of Calaveras Dam on Alameda Creek when Calaveras Reservoir spills at the same time high flows are being conveyed in the Arroyo de la Laguna or in the unlikely event of sudden dam failure. The SFPUC has no contractual obligation to provide flood control, and the dam and reservoir operate as a water storage facility. The reservoir’s large size impounds runoff from large storm events in the Arroyo

Hondo and Calaveras Creek sub-watersheds, attenuating peak inflows and providing incidental flood control benefits. The dam has functioned in this capacity since 1925.

During 1950, 1955, and 1963 when floods occurred downstream on Alameda Creek in Fremont before the flood control channel was constructed, Calaveras Dam did not spill, indicating that Calaveras Reservoir provided incidental flood control benefits during those events. In 1952, Calaveras Reservoir spilled in four different periods, for a total of about 3.5 months. Calaveras Reservoir also spilled in 1958 and 1967, indicating that flows passing Calaveras Reservoir may have contributed to flood flows in the downstream channel. The specific dates of flood events are unknown, so it is not possible to correlate spill events with the particular time of historical flooding. Overall, Calaveras Dam historically assisted in reducing the intensity of flooding downstream by reducing peak flows through its storage function.

The 2001 DSOD order reduced the allowable water storage level of Calaveras Reservoir to an elevation of 700 feet (subsequently increased to 705 feet) and in response to that requirement, the SFPUC used the cone valve to remove water from the reservoir and prevent spills through the spillway. During large rainfall events, the SFPUC has released water through the large cone valve (“Big Blue”) during periods when the reservoir fills above the 705-foot level. Cone valve releases occurred in 2001, 2002, 2005, and 2006, sometimes for 2-3 months. In each event, notifications were sent to a number of public agencies in advance, including the ACFCWCD, ACWD, Alameda County Sheriff’s Office, Alameda County Office of Emergency Services, Caltrans, California Highway Patrol, EBRPD, SFPUC Natural Resources Division, and Pacific Gas and Electric Company (PG&E). These occasional releases have raised downstream water levels in Calaveras and Alameda Creeks, but have not resulted in damaging flooding downstream of Calaveras Dam. Although there has been no recorded need since 2001, in an emergency, the flow can be reduced and stopped in less than 1 hour.

A flood in the lower Alameda Creek watershed could affect those areas and communities located downstream of Calaveras Dam, including the communities of Sunol and Niles, and Fremont, Union City and Newark (flooding of the latter communities is unlikely due to the installation of the flood control channel on lower Alameda Creek). The major flood threat to Niles, Fremont, Union City and Newark is derived from flows in the Livermore Valley passing down the Arroyo de la Laguna and lower Alameda Creek. Lake Del Valle is a combined water storage and flood control facility upstream of Livermore. Calaveras Reservoir and San Antonio Reservoir both serve as storage facilities and incidentally for flood control; that is, neither is designated as a flood attenuation facility. With current restricted storage, high flows must be passed at Calaveras Dam, so that any function for floodwater storage is somewhat diminished under current conditions. The DSOD does allow the SFPUC to use Calaveras Reservoir to retard runoff in large storms, as long as the target pool elevation is restored when it is prudent to do so. Although no major flood has occurred since DSOD restrictions on pool level were implemented, SFPUC

system operators allow Calaveras Reservoir to temporarily rise above 705 feet, as in March 2006. Thus, Calaveras Reservoir continues to provide incidental floodwater detention, and having a DSOD-restricted lower water level, it still has a large capacity to temporarily retain floodwaters should they occur.

Dam Failure Hazard

The potential catastrophic failure of Calaveras Dam would result in substantial flood inundation in Calaveras and Alameda Creeks. The current dam and foundation would likely experience damaging deformation, slumping, and failure in the event of a major earthquake on the adjacent Calaveras fault (Olivia Chen Consultants 2003). For this reason, the DSOD imposed restrictions on the water level in Calaveras Reservoir.

The inundation zone downstream from Calaveras Reservoir that could be flooded in the event of a dam failure was evaluated in 1975 for the existing dam and assumed the pre-DSOD restriction operation level of the reservoir (SFWD 1975). Inundation mapping integrates analysis of hydrologic, meteorological, and topographical data affecting the dam site and downstream areas as well as floodwater routing. The 1975 inundation map showed the limit of inundation starting from Calaveras Dam and stretching to San Francisco Bay (ABAG 1995). In the case of catastrophic dam failure, floodwaters from Calaveras Reservoir are predicted to travel along Calaveras Creek and nearly reach the confluence with Alameda Creek in 45 minutes. Floodwaters would then continue along Alameda Creek and at 1 hour begin to spread across the Sunol Valley. Once floodwaters pass through the community of Sunol, they would reach the mouth of Niles Canyon at a time of 1 hour and 23 minutes and would exit the canyon at a time of 2 hours. Floodwaters would then overtop the levees and spread across the Niles Cone and flood portions of the communities of Fremont and Niles. The Quarry Lakes would be affected in approximately 2 hours and 30 minutes, along with I-880 in 4 hours. Floodwaters would eventually reach the communities of Newark and Union City at the final mapped time interval of 5 hours and 30 minutes.

In addition, Association of Bay Area Governments (ABAG) considered a catastrophic failure of all the key reservoirs along Alameda Creek including Calaveras Reservoir, San Antonio Reservoir, and Del Valle Reservoir. According to ABAG, lands within the Sunol Valley, Niles Canyon, and the Niles Cone could be inundated by up to three reservoirs at one time. This area includes the communities of Sunol, Niles, Fremont, Union City, and Newark. This assumes catastrophic failure of all three dams simultaneously. Such an event of multiple catastrophic dam failures could only be generated by a massive earthquake of region-wide proportions and has an extremely low probability of occurring. With the pre-DSOD restriction capacity of 96,850 AF, Calaveras Reservoir would be the largest reservoir to contribute to these cumulative flood flows.

This information is available through ABAG's interactive geographic information system (GIS) based website (ABAG 1995).

At present, under DSOD-restricted storage, a failure of Calaveras Reservoir would release no more than 38,100 AF, assuming a catastrophic event resulting in the emptying of all water in the reservoir. It should be noted that the DSOD order is based on an assumed partial slump on the dam face and limits storage to below the elevation of the hypothetical failure plane that would occur during an earthquake. If Calaveras Dam partially failed, the SFPUC in theory would have the opportunity to release water on a controlled basis from the cone valve, limiting any potential for further flooding. At present, under DSOD-restricted storage, Calaveras Reservoir would release no more than 38,100 AF, assuming all the current storage were to empty in a failure event under the nominal storage.

Geomorphology and Sediment Transport

The entire Alameda Creek watershed is the product of land-forming processes (geomorphology) that were predominantly created by the uplift of the region and downcutting by streams, processes which continues into the present. Watershed slopes are formed by processes of weathering, erosion, sediment deposition, and mass wasting (e.g., landslides). The loosened materials from these processes are transported into creeks and ultimately the master stream of the region, Alameda Creek. With active erosion, downcutting and uplift occurring together, almost the entire watershed is land in slope and the large streams are mostly incised features with the ability to carry substantial sediment loads. Because of these conditions the upper watershed provides an abundant supply of sediment to the stream system.

The Alameda Creek Hydrologic Area geomorphology and sediment transport systems have been substantially altered by dams, weirs, channelization, aggregate mining, induced erosion, vegetation changes, grazing, land development, and structures in the channels. In the southern watersheds, including the project area, these structures and uses have influenced the geomorphologic systems for more than 150 years. Only the upper portions of the watersheds, mostly steep hill lands, retain a somewhat natural system. Other parts of Alameda Creek have been controlled by combinations of the other forces of change and control of natural hydrology for 80 years. Calaveras Dam, the ACDD, and Turner Dam are major controls over the fluvial system in this portion of the Hydrologic Area. Within the study area, Calaveras Dam (constructed 1918) and the ACDD (1931) have exerted strong influence over flows and sediment transport processes since the early part of the 20th century. Turner Dam (San Antonio Reservoir) was completed in 1965. The result has been a long period of regulated streamflow, trapping of sediment behind the dams, and changes in channel erosion and aggradation downstream of the dams.

The middle Alameda Creek watershed is predominantly open space with grazing and protected habitat for watershed and recreation. Urbanization is absent. The geomorphic system has been primarily altered by dams, mining, in-channel barriers including Sunol Dam (which has been removed), the PG&E grade control structure, and USGS structure, and by indirect controls on streams through losses of surface flow into the SMP-30 mining pit and the Sunol infiltration galleries.

Channel Morphology and Sediment Transport in the Primary Study Area

Channel morphology (form) is controlled by multiple variables. Chief among these are streamflow, sediment transport, gradient, and channel and bank materials. These interrelated variables shape channel forms and materials in the stream channels, as discussed below.

Sediment includes inorganic material derived from weathered rock, organic material derived from plants and animals, soil that includes both inorganic and organic matter, and material in solution that precipitates out and collects on the bed. Sediment is important to stream systems because it provides the “tools” of erosion, forms bed materials that are needed by fish and wildlife, introduces nutrients into waterways, affects water quality, provides substrate for aquatic vegetation, and has many other effects. Inorganic sediment comprises material derived from weathered rocks and soil on slopes and is classified by the size of the particle. Ranging from smallest to largest, inorganic sediments include clay, silt, sand, gravel, pebble, cobble, and boulder. Organic sediments include very fine particles of colloidal material, detritus (partially decayed material), leaf matter, human and animal wastes, animal remains, twigs, branches, and very large woody debris (e.g., large fallen limbs and tree trunks). In this watershed, inorganic sediment constitutes by far the greatest volume of sediment.

Clays and silt make up the “fine” fraction of inorganic sediment. Fine particle sediment also consists of organic materials floating in the water and carried in suspension. Because of their small sizes, clays, silts, and fine organic material are transported by suspension in streams and can be carried long distances if sufficient flow and velocity are maintained. They require slow-moving or still water to settle out and form mud deposits. Clays and silts create most of the turbidity of water. For most streams of the region, including Alameda Creek, fine sediments make up by far the greatest amount of material carried in streams (called the “suspended load”). Coarse sediments consist of sand, gravel, and pebbles. Large sediments are made up of cobbles and boulders. Although very fine sands can be mobilized by low flows, most of the coarse load of a stream can be transported only with increasingly higher flows capable of moving the larger sized material by picking up particles briefly and by pushing, rolling, and undercutting them. Because of their size, these particles remain near the bottom and thus are called the “bed load.” Moderate to high flows are required to move the coarse load. Very high flows are required to move cobbles and boulders. Coarse streambed sediments are preferred by some fish species, such

as trout and steelhead, for spawning, particularly gravels and pebbles, which can be moved by the fish for spawning beds (called “redds”). Large cobbles and boulders provide habitat for protection, promote mixing and aeration of the water, and have other functions.

Woody debris is an important part of the sediment load. Large woody debris creates habitat for multiple types of wildlife, provides areas of concealment and protection for animals, shades the creek and cools the water, creates obstacles to flow that add to aeration of the water, and has other benefits. Because of its location in an undeveloped, widely wooded area on steep slopes, the watershed produces a good deal of woody debris that is part of the stream load. The larger the size and weight of the woody debris, the higher is the streamflow volume and velocity required to transport it. Leaf meal and detritus are moved easily by low flows, but large tree limbs and fallen trunks can be moved only by very high streamflow.

As long as there is flow in a stream, some sediment is moved. In general, sediment transport increases as a power function of the increase in discharge. For each unit increase in discharge, there is an even greater increase in sediment transport. This effect is most pronounced during high flows, when even a small increase in flow can result in an enormous increase in sediment load. Sediment transport is dynamic and ever changing. Whenever there is streamflow in a channel, both erosion and deposition occur. When the sum of the processes results in more sediment transported out of the reach, the reach is eroding (degrading and/or cutting laterally into the banks). When the sum of the processes results in more sediment dropping out of the flow, sediment deposition (or aggradation) occurs. The term “sedimentation” refers to the process of accumulation of sediment in a channel. The term often has a negative connotation because of the common problem of excessive sediment accumulation when a stream sediment transport system is out of its natural balance. However, sedimentation serves important beneficial ecological functions in streams that are in equilibrium.

Calaveras Dam creates a significant sediment trap in the southern watershed and Turner Dam traps sediment from its substantially smaller catchment area. Calaveras Dam captures the runoff and entrained sediment derived from a total area of approximately 98 square miles. Calaveras Reservoir essentially traps all of the bed load and almost all of the suspended sediment. A small amount of suspended sediment passes through the outlet works and is removed at the SVWTP. Some suspended sediment also passes the dam in cone valve releases, and in the past in spills, but the far greater volume of that material settles out in the reservoir and is permanently trapped there. Thus, almost no sediment discharge is generated by Calaveras Reservoir, and its operation contributes almost no sediment downstream to Calaveras Creek and Alameda Creek. The ACDD also has functioned as a sediment trap, although mostly by diverting sediment in the flows directed into Calaveras Reservoir. Because of its smaller size, some sediment also is carried by the creek over the ACDD. An estimated 7.8 million cubic yards of sediment is trapped behind Calaveras Dam. This volume equates to approximately 86,700 cubic yards of material on average

per year removed from the Alameda Creek sediment transport system since 1918, when the dam was first constructed. Although detailed sediment budgets have not been developed, based on these general geomorphic principles, Calaveras Dam (with input from the ACDD) over the years has resulted in a substantial reduction in sediment load downstream in Alameda Creek.

Streamflow and Alameda Creek Geomorphology

Streams are the most important force creating landforms in the region. Streams do their “work” through erosion and deposition. Sediment entrained in the streamflow provides the tools of erosion and the material forming channel deposits. The contribution of streams to channel erosion is directly related to streamflow. As noted previously, the streams forming the Alameda Creek system naturally have highly variable flow from year to year, and in each year, there is a distinct period of higher flow in winter/spring and low flow in summer and autumn. For individual storm events, the flow also is highly variable within a short period and thus is referred to as “flashy” or “episodic.” This type of streamflow system is characteristic of the central California coastal region and provides flow conditions that shape stream channel morphology and support the distinguishing characteristics of riparian environments (Hecht 1994). High flows have the ability to transport immense amounts of sediment, large-sized material in the bed load, and large woody debris. During high flows, most of the suspended load in the stream is moved. In the occasional large storms, creeks in the watershed have short-period high flows (ranging from a few hours to days in duration) during which an immense sediment load is transported down the channel. Soon after the storm passes and peak flows subside, the transport power of the water drops, and the sediment load drops rapidly in the channel and adjacent areas of overflow. The effect on channel form in such events can be dramatic, including rapid bank and bed erosion in some areas and sedimentation elsewhere. These episodic storm events play an important role in shaping the channel morphology of Alameda Creek, notably in the steeper upper watershed.

The dams have altered the surface flow characteristics of Alameda Creek for 90 years, as described herein. Large episodic flows and their accompanying sediment transport in Calaveras Creek and Alameda Creek have been substantially reduced by Calaveras Dam over the decades (compare, for example, flow in Arroyo Hondo in Figures 4.6.3a and 4.6.3b to the flows in Calaveras Creek downstream of the dam [prior to dam construction that reach was the mainstem of Calaveras Creek and Arroyo Hondo] in Figure 4.6.6). Calaveras Dam captures the high flows and spills during very large storms as well as the sediment carried by Arroyo Hondo and other creeks flowing into the reservoir. During the baseline period, the heavy storms in winter and spring 2005/2006 were sufficiently high that no diversion occurred at the ACDD and yet releases were made through the cone valve at Calaveras Dam because of the high inflow from Arroyo Hondo and Calaveras Creek.

At the ACDD, when diversion does not occur, both the flow and most sediment load pass over the dam. When the flow at the ACDD is diverted into the tunnel, flows in Alameda Creek are reduced, and the water has reduced ability to transport sediment downstream because most of the sediment is diverted in the flow up to 650 cfs to Calaveras Reservoir, where it is permanently trapped. During diversion, all flow above 650 cfs passes over the dam and carries the suspended sediment into the downstream channel. The amount of flow and sediment is quite variable. In some years with few or low passing flows, the amount of downstream sediment transport is small. In years with episodic very high peak flows at the ACDD, flows have reached 3,400 cfs, and most of the suspended load and some of the bedload were carried over the dam and downstream as a very large mobilized sediment mass (commonly referred to as a sediment “slug”). Because of the high-flow conditions, these sediment slugs were carried a great distance downstream in the creek and were added to the sediment input of other tributaries of Alameda Creek. In sum, although such episodic high-flow events are relatively infrequent, they play a very substantial role in sediment transport in Alameda Creek at and downstream of the ACDD under existing conditions.

Subsequent flows after episodic high flows and moderate flows in years with reduced peak flows continue to move and redistribute the sediment slugs from the high flow events down the stream course. Most of that material is suspended sediment. As suspended sediment comprises by volume the greatest amount of sediment load of the creeks, it follows that most of the transport occurs during the more moderate flows, which occur with greater frequency and duration than the rarer high-flow events. These moderate flows dominate the channel formation in areas with alluvial valleys, such as Alameda Creek in the Sunol Valley, and are referred to as “dominant flow/discharge.” However, in steep-gradient incised channels like those in the upper watersheds, the dominance of the moderate flow is less meaningful in channel morphology. In those areas, moderate flows are needed to transport the suspended load, but deep alluvial deposits forming the channel and banks are absent.

The operations of Calaveras Dam and the ACDD have strongly reduced flows in downstream reaches, thereby reducing the effectiveness of the moderate flows in transporting sediment and reducing effects on channel morphology. Calaveras Creek downstream of the dam is starved of sediment because the sediment is trapped behind the dam and flow capable of transporting suspended sediment is all but eliminated except during cone valve releases. In sum, the moderate dominant flows have been eliminated, so the associated sediment transport functions have been lost in Calaveras Creek downstream of Calaveras Dam. For that reach, sediment transport depends entirely on relatively small inflow from adjacent slopes and the occasional moderate flow (i.e., in the range of 336–375 cfs) from a cone valve release (Table 4.6.12).

Because the ACDD is operated in the baseline with and without diversions, the effect on moderate flow and associated sediment transport is variable. When no diversion occurs, all of the flow and transportable sediment load are carried over the dam and into Alameda Creek. Channel-

forming dominant flow likely occurs at approximately 600 cfs (based on statistical streamflow records) just upstream of the ACDD; thus, when the diversion is occurring (with a capacity of 650 cfs), all of it and its sediment load are diverted to Calaveras Reservoir. When diversion occurs, only the remaining portion of the flow above 650 cfs passes the dam, thereby reducing the frequency at which dominant flow occurs. To reduce the buildup of sediment behind the ACDD, the SFPUC conducts a controlled flushing of sediment at moderately low flow, an operation referred to as “sluicing.” In the sluicing operation, a sluice gate is opened, allowing water to flow through the dam under moderate flow conditions. The sediment trapped behind the ACDD becomes entrained and is carried in the flow downstream, where it is distributed in the channel. Sluicing is typically a 48-hour flush at about 50 cfs and results in transport of about 900 cubic yards of sediment. It is typically carried out in February.

Overall, operations of Calaveras Dam and the ACDD during the baseline period have not substantially altered their sediment trapping and transport effects from those that occurred in pre-DSOD restricted operations. Except for sluicing releases at the ACDD, the result is effective removal of most coarse sediment derived from the watersheds upstream of the dams from its transport into the downstream reaches of Alameda Creek. The capture of sediment behind Calaveras Dam over time has resulted in decreased sediment loads downstream of the dam, reduced dominant discharge downstream of both dams, and decreased transport capacity of what sediment is present. Incision of the channel and rock armoring (that is, a channel composed mostly of cobbles, large boulders, and exposed bedrock and lacking fine and coarse sediment) are the outcomes of these altered processes. At present, most sediment transport in the stream system relies on the high peak flows, especially the episodic very high flows, supplemented by much smaller annual sluicing at the ACDD. Because these effects have been established for more than 90 years at Calaveras Dam and since 1931 at the ACDD, although with lesser impact, the natural sediment input and transport of Alameda Creek were put out of equilibrium by the dams and continue so at present. Although the baseline operation has experienced more intermittent diversions at the ACDD, this change has not been of sufficient duration or magnitude to change the underlying baseline geomorphic conditions in Alameda Creek. Thus, the baseline conditions are similar to historical conditions.

Gradient and Channel and Bank Materials

Gradient is an important control over channel morphology because it affects flow conditions. The watershed is divided into two major gradient zones (see Figure 4.6.5). The upper watershed has relatively steep creek gradients. The steeper gradients of upper Alameda Creek tend to promote a natural flushing action; that is, suspended sediment enters the channel and is moved relatively quickly through the steep reaches as long as adequate flow is available. For this reason, deep alluvium is absent or relegated to pockets between reaches of rocky beds. The reservoirs behind the dams and some natural barriers are the only current zones of deep sedimentation.

Downstream of the confluence with Calaveras Creek, there is a notable break in gradient. In the reach between that confluence and Sunol Valley, there is more opportunity for both transport through the system and deposition of alluvium. The lower gradient in Sunol Valley supports a depositional environment, and deep alluvial (stream-laid) deposits from the channel banks and bed.

Obstructions to flow alter gradient controls (referred to as “nickpoints”). Thus, dams and the PG&E grade structure, as well as natural nickpoints (for example, Little Yosemite), locally affect sediment transport. Typically, aggradation occurs upstream of the obstruction, and erosion occurs downstream of the structure. Because of the many human-made obstructions in the watershed, some that dated to the mid-1800s in Niles Canyon (the dams have been removed by the SFPUC), natural stream gradient is substantially altered throughout the watershed between San Francisco Bay and up to and including Calaveras Dam and ACDD. In addition, natural flow conditions in the Sunol area have been highly altered by collection of subsurface flow in the SFPUC’s infiltration galleries and by uncontrolled seepage into the SMP 30 quarry pit. These have the effect of removing flow from the channel and thus substantially reduce the frequency of dominant flow events in that reach.

Bed materials can be generally distinguished according to hard surface materials and soft sediments. The former consists of rock-armored channel and the latter of alluvium (stream-laid deposits consisting of a mixture of fines, coarse sediments, and large-sized materials). In general, hard-surfaced channels offer poorer habitat quality, whereas alluvium provides much greater habitat quality, especially where it consists of a variety of substrate conditions that result in pool and riffle sequences.

The following discussion of geomorphology is organized according to the primary study area of upper Alameda Creek (upstream of Niles Canyon) and the extended study area (Niles Canyon and lower Alameda Creek Reaches).

Upper Alameda Creek

The SFPUC’s Alameda Creek watershed upstream of Niles Canyon is comprised of two general landform (geomorphic) regions: the “canyon areas” upstream of the SVWTP and the Sunol Valley. The Calaveras Dam site and the ACDD are located within the canyon area. As indicated in Figure 4.6.5, stream channel gradients are steep upstream of the confluence of upper Alameda Creek and Calaveras Creek, where a significant break in the gradient occurs. Downstream of the confluence, the gradient of Alameda Creek is much reduced down to and including the Sunol Valley. The geomorphology of the canyon areas can be further divided into reservoir and stream

channels. The fluvial geomorphologic characteristics⁴ of each of these areas are described below for the same reaches presented in Section 4.5, Fisheries and Aquatic Habitat, as those reaches were defined fundamentally by geomorphologic elements (gradient and substrate).

- **Reach A-1 (Alameda Creek):** From the outlet of the Sunol Valley (approximately at the SFPUC Water Temple) upstream for about 3.5 miles, Alameda Creek flows through a wide, low-gradient (approximately 0.5 to 1 percent) alluvial valley. The stream channel is relatively wide and shallow and is occasionally braided. The Sunol Valley has been created naturally since the Quaternary Period (approximately the last 2 million years) as a large deeply filled sedimentary basin, in which Alameda Creek deposited its sediment load before entering Niles Canyon. The stream system in the area has been highly altered by human activities. The lower part of the channel in the Sunol Valley has been heavily influenced by gravel mining activities, including relocation of the channel in some locations and drainage pumping of underflow from Alameda Creek that finds its way into the quarry pits. This is particularly true in the quarry operation on the right bank upstream of the San Antonio Creek confluence, which, unlike all of the other SFPUC quarry lease areas, lacks a bentonite cutoff wall to prevent inflow or seepage. In addition, the PG&E pipeline grade control structure causes a loss of approximately 10 feet in stream bed vertical elevation (Gunther et al. 2000:33). Prior to its construction, the 10 vertical feet of channel grade would have been distributed along the length of the channel upstream. After its construction, the structure became a nickpoint that serves as a sediment barrier, resulting in aggradation (sediment deposition) of the channel. The aggradation caused an increase in stream channel width and shallow depth. The stream channel consists primarily of sand and in some areas cobble and gravel substrate. The channel is braided in some locations, indicating an area of substantial aggradation (sediment deposition) and channel instability. Most of the material is derived from fluvial transport of sediment from upper watershed areas. The immediate topography has generally low sensitivity to erosion and sediment generation (SFPUC 2001: Figure 2-2, “Erosion and Land Instability”). Streamflow in this reach becomes intermittent or ceases completely during the dry season and has been influenced by operations at both the ACDD (during the wet season) and Calaveras Dam (year round). The lower segment of the reach that flows through the area of gravel mining operations is a heavily altered (realigned trapezoidal) channel. Additionally, the SFPUC’s Sunol infiltration galleries collect substantial subflow in the creek, which in turn affects surface flow and the ability and competency of Alameda Creek to transport sediment. The reach is largely dominated by sedimentation.
- **Reach A-2 (Alameda Creek):** About 0.5 mile downstream of the bridge near the entrance of the SVWTP to the confluence of Calaveras Creek, the valley narrows and the stream becomes more confined, primarily within a single channel. The floodplain widens closer to the confluence. The gradient is relatively low in this reach (approximately 1 to 2 percent). Much of the pool habitat is relatively deep (2.5 feet maximum depth or greater). Streamflow during the summer may become intermittent in dry years. Slope erosion sensitivity varies from high in the lower portions of the reach to moderate and low closer to the confluence (SFPUC 2001: Figure 2-2). Similar to Reach A-1,

⁴ The term “fluvial geomorphologic characteristics” refers to changes in the shape of the stream channels and associated erosional and depositional features (e.g., canyons, streambeds, stream banks, floodplains), and the hydrologic and geologic processes and conditions, particularly stream flow, contributing to or affecting those changes.

streamflow in this reach is influenced by operations at both the ACDD and Calaveras Dam.

- **Reach A-3 (Alameda Creek):** Just upstream of the Calaveras Creek confluence including the area commonly referred to as Little Yosemite, the Alameda Creek channel gradient becomes very steep (approximately 15 percent), is confined by the steep canyon slopes, and has little or no floodplain. The substrate is dominated by boulder and bedrock armoring. Fine sediment is transported through this reach by high and dominant flows. There are numerous cascades, bedrock chutes, and waterfalls in this section of the creek. There is usually at least intermittent streamflow in this reach during the dry season. Streamflow in this reach is influenced by operations at the ACDD. The adjacent slopes have high erosion sensitivity generated by both high soil erosion and mass wasting (landslides) (SFPUC 2001: Figure 2-2).
- **Reach A-4 (Alameda Creek):** Upstream of Little Yosemite to the ACDD, the stream gradient generally decreases (approximately 2 to 4 percent); however, there are a few relatively steep sections (greater than 10 percent). The channel is less confined than in Reach A-3. Portions of the channel are dry during the summer season. The ACDD forms the upper boundary of Reach A-4. The channel characteristics vary by reaches that alternate between alluvial substrate and steep exposed bedrock armored channel. Operation of the ACDD (i.e., diversion of water to Calaveras Reservoir and sluicing to pass through sediment) greatly influences sediment transport conditions. Since 2001, more flows have been bypassed at the ACDD than in the previous years. It is likely that more moderate (bankfull) discharge flows (see previous discussion) have occurred in these bypass flows. As a result, flows have been able to transport more sediment past the ACDD and through this reach than in the past; Alameda Creek was free-flowing in 3 of the 8 baseline years. The 2006 water year had high winter and spring flows with capacity and competency to move large sediment loads over the ACDD and through Reach A-4 and downstream reaches as well as cause scour. Diversions in the other baseline years reduced sediment transport and reduced the potential scour of the creek. Sluicing flows were not carried out in 2002; in that year, the very high flows (up to about 2,700 cfs) that occurred were capable of transporting far greater volumes of sediment than sluicing flows could. In that year, and during that same flow event, diversion occurred at the ACDD at 650 cfs. Thus, some of that sediment load was transported through the tunnel to Calaveras Reservoir. The much greater remainder of flow (2,000+ cfs) proportionally transported the volume of sediment over the ACDD into Reach A-4. Moreover, such large flow events were able to move large bed load materials (e.g., boulders) and large woody debris. Sediment transport of similar (although somewhat reduced) magnitude occurred in early 2004 (with diversion) and winter/spring 2006, as noted (without diversion). In all other years, sluicing at 50 cfs was conducted, which had the effect of creating more average sediment transport (smaller volume and smaller sized material as suspended sediment as well as some traction load such as sand). In this reach, the adjacent slopes have high erosion sensitivity generated by both high soil erosion and mass wasting (landslides) (SFPUC 2001: Figure 2-2).

The sluicing of upper Alameda Creek at the ACDD indicates that, in the narrower, steeper reaches of the creek, smaller flows are adequate to transport accumulated suspended sediments. Such smaller flows also may affect the local geomorphic conditions of the small alluvial flats, banks, and terraces adjacent to the stream channels upstream of Sunol Valley.

- **Reach A-5 (Alameda Creek):** From the ACDD to Camp Ohlone the stream characteristics are similar to Reach A-4 for several miles, varying between step-runs, pocket water, cascades, and bedrock chutes that are typically associated with higher gradient streams. Calaveras Dam operations do not influence streamflows in this reach. The adjacent slopes have variable erosion sensitivity. Some tributaries have moderate sensitivity, but the majority of the tributaries drain areas with high soil erosion and mass wasting (landslides) (SFPUC 2001: Figure 2-2).
- **Reach A-6 (Alameda Creek - upstream of Camp Ohlone):** This reach has both low gradient, alluvial sections that are dry or intermittent in summer and steeper gradient sections dominated by bedrock and boulders with year-round flow. The higher gradient sections include features with large bed elements, low amounts of fine sediments, and a high proportion of relatively deep pools. Summer streamflow is low; Calaveras Dam and ACDC operations do not affect this reach. At three locations, steep boulder falls (nickpoints) are present. The adjacent slopes have variable erosion sensitivity. Some tributaries have moderate to low sensitivity, but the majority of the tributaries drain areas with high soil erosion and mass wasting (landslides) (SFPUC 2001: Figure 2-2).
- **Reach C-1 (Calaveras Creek – downstream of Calaveras Reservoir):** Reach C-1 is 0.6 mile extending from the confluence with Alameda Creek upstream to Calaveras Dam. The reach consists of deep pools, glides, and short low-gradient riffles formed by steep rocky gorge-type topography with bedrock and large boulders (rock armoring). Stream hydrology is highly altered by the operation of Calaveras Dam, experiencing low base flows except during periods when the reservoir releases are made through the cone valve to maintain DSOD requirements. Adjacent areas have low to high sensitivity for erosion, including landslides (SFPUC 2001: Figure 2-2).
- **Reach C-2 (Calaveras Creek – upstream of Calaveras Reservoir):** Calaveras Creek upstream of Calaveras Reservoir currently lacks hydrological connection with the reservoir at the lowermost segment of the creek due to the lack of a defined channel and riparian vegetation structure. Upstream from this segment, the creek exhibits a more defined channel form with a moderate gradient, confined stream with varying flow, primarily gravel and cobble substrate, and relatively dense riparian vegetation. Calaveras Dam operations do not influence streamflows in this reach. Upper reaches of the creek include higher gradient sections flowing in steep to moderately sloping canyons with segments of narrow floodplains interspersed with bedrock channels. The upper reaches of the creek likely convey substantial amounts of sediment from the eroding and mass wasting slopes of the adjacent hills. Much of this portion of the watershed has moderate sensitivity to erosion (SFPUC 2001: Figure 2-2). Sediments transported in this reach of creek ultimately are deposited in Calaveras Reservoir.
- **Reach AH-1 (Arroyo Hondo):** For about 1.8 miles upstream of the upper storage elevation of Calaveras Reservoir, Arroyo Hondo is a moderate gradient, confined stream with perennial flow, and having primarily gravel and cobble substrate. Below the upper storage elevation down to the DSOD required elevation, Arroyo Hondo exhibits conditions that are a result of historical inundation. These conditions include a channel with shallow riffles, glides, and bars as it crosses the former inundation zone. At the lower portion and below this zone, ongoing reservoir operations influenced the formation of sediment wedges at the confluence with the reservoir. These sediment wedges can elevate sediment loads during active sediment wedge mobilization. At the upper end of this reach, a massive landslide has deposited large boulders in the creek, forming a series

of steep cascades and falls and generating large sediment loads which ultimately become deposited in the reservoir and are trapped there permanently. Calaveras Dam operations do not influence streamflows in this reach.

- **Reach AH-2 (Arroyo Hondo):** There are many miles of Arroyo Hondo and its tributaries in a relatively undisturbed landscape upstream of the landslide. This reach of Arroyo Hondo is not influenced by Calaveras Dam operations or the proposed project. The streamflows with relatively high gradients through an area of high sensitivity to erosion and mass wasting (landslides) (SFPUC 2001: Figure 2-2). Sediment from Reach AH-2 also is ultimately deposited in Calaveras Reservoir.

The Sunol Valley has lower gradients than the canyon reaches of Alameda Creek, and the channel bed and banks are primarily comprised of sediments. Grade controls (where erosion is restricted by a solid feature such as a bedrock outcrop, weir, or dam) in the Sunol Valley include the PG&E gas line crossing and the stabilization structure built by the SFPUC just downstream of the bridge to the Alameda West portal of the Irvington Tunnel.

Niles Canyon and Lower Alameda Creek

Niles Canyon is characterized by steep, moderately vegetated hillsides terminating in the canyon floor. The canyon floor includes State Route 84 and two railway lines (Niles Canyon Railroad and Union Pacific Railroad), including artificial embankments and bridges over the creek. Channel gradients range from 0.013 foot/foot (ft/ft) to 0.0025 ft/ft, averaging 0.005 ft/ft. The main channel bed and overbank of Alameda Creek is broad and deep in reaches; it is characterized by pool, riffle, run sections with a bed, banks, and bars of gravel and sand with occasional cobbles and boulders. A number of nickpoints occur in the stream profile and are accounted for by manmade weirs (one located upstream of the former Niles Dam site and the other located at the USGS gage downstream from the Niles Dam site) as well as natural features such as bedrock outcroppings (Weiss Associates 2004). Alameda Creek in the Niles Canyon reach is moderately entrenched, with some reaches that are well-entrenched (Weiss Associates 2004). The floodplain, which is constrained by steep hillsides, State Route 84, and the railway, is moderately vegetated with trees and other riparian vegetation and is typically 20–200 feet wide.

The flood control channel of Alameda Creek flows through the relatively flat, urban landscape of Fremont, Newark, and Union City. The flood control channel downstream of Niles Canyon has significantly lower grades, with an overall gradient of 0.001 ft/ft. Prior to urban development, this reach of creek likely flowed through a series of marshes, sloughs, and seasonal ponds and percolated into the floodplain. The current channel was developed between 1965 and 1975. The channel is trapezoidal in shape, with rip-rap-protected levy walls and a broad base. A low flow channel meanders within the base of the flood control channel, which is comprised primarily of fine sediments, sand, and gravel. Riparian vegetation exists along portions of the base and slopes of the flood control channel. Ongoing maintenance activities within the flood control channel

periodically alter the morphology and vegetation surrounding the low flow channel when deposited sediments are removed to maintain the capacity of the flood control channel.

An average of approximately 270,000 tons (160,000 cubic yards) of sediments is transported by Alameda Creek annually. A study performed as part of the Sunol Dam removal in Niles Canyon determined that these sediments are about one-quarter to one-third sand and two-thirds to three-quarters gravel at that former dam site in the Canyon. These sediments are transported by high winter flows in the creek; for example, the estimated 3.5-year streamflow of Alameda Creek at the former Sunol Dam site (approximately 7,000 cfs) transports a volume of sediment equal to about 25 percent of the average annual sediment load in the creek (Weiss Associates 2004). Sediment transport curves developed by Weiss Associates for Alameda Creek near Niles indicate minimal sediment transport with flows of less than 20 cfs; thus, during summer periods little sediment transport occurs. Sediment transport increases from 10 to 1,000 tons per day when streamflows increase from 100 to 1,000 cfs. At a flow of 2,000 cfs, estimated sediment loads approach 10,000 tons per day, which include both suspended sediment and bedload transport.⁵ At Niles Canyon, there is virtually no bedload transport⁵ with streamflows under 1,000 cfs, and 2,500 to 6,000 tons per day with flows of 10,000 cfs (Weiss Associates 2004).

The ACFCWCD removes about 300,000 cubic yards of sediments from its flood control channel downstream of Niles Canyon every 10 years; this constitutes about 19 percent of the total creek sediment load. The remaining sediments are either deposited in parts of the flood control channel not subject to maintenance and/or are eventually transported and discharged into San Francisco Bay (Weiss Associates 2004). It should be noted that these are long-term averages, and annual sediment loads vary widely depending on runoff events and watershed conditions. A substantial, but unknown, amount of this sediment reaching Sunol and moving through the Niles Canyon is generated in the Vallecitos, Arroyo Mocho, Arroyo Valle, and Arroyo de la Laguna watersheds, outside of the SFPUC watersheds. Those watersheds include large alluvial valleys where erosion due to natural channel meandering, as well as land management practices for mining, agriculture and urban development, have generated substantial sediment volumes in the past. In recent decades, more stringent controls of soil erosion related to farming and urban construction likely have substantially reduced sediment from those areas, but a large volume of sediment likely remains in the creeks that is potentially available for transport downstream. The northern watershed has been experiencing substantial hydromodification since the 1960s related to urbanization. As a result, the general change in runoff pattern has been to increase the amount and rate of surface runoff as related to increased impervious surface area. This runoff generates high peak flows that are able to mobilize sediment and transport it; that is, both stream capacity (amount of material the stream can carry) and competency (the size of sediment particles) are

⁵ Suspended sediment is transported in the water column. Bedload refers to the amount of fine sediment, cobbles, gravel, and boulders transported along the stream bottom (being pushed, sliding or hopping by the force of the stream flow).

increased during the storm event. Such storms are followed by a rapid drop in runoff following the peak, with a concomitant drop in stream capacity and competency and resultant drop in the sediment load.

Groundwater

The primary groundwater resources in the Alameda Creek watershed are in the Livermore and Sunol Valleys, and farther downstream in the Niles Cone area near the town of Niles. In SFPUC-owned watershed areas upstream of the Livermore and Sunol Valleys, small amounts of localized groundwater can be found in the shallow alluvial areas that are interspersed with steeper bedrock sections along watercourses. Groundwater in these areas is often through-flow associated with flows in the streams. The proposed project would not affect upstream areas in the Livermore Valley; therefore, this section focuses on groundwater in the Sunol Valley and in the Niles Cone.

Upper Alameda Creek

The Alameda Creek watershed generally comprises northwest-trending ridges and intervening valleys, the orientations of which are strongly controlled by the structural patterns of the underlying bedrock. For the purposes of visualizing the groundwater system in the project area, the geologic units can be divided into two main types. The deepest bedrock is characterized by well-compacted and lithified (consolidated and hardened into rock) marine sedimentary rocks (Panoche Formation). Because of their compact nature, low permeability, and strong structural deformation, these rocks are considered non-water-bearing or, at best, very low water-yielding.

In contrast, the younger surficial deposits are unconsolidated to only slightly compacted. These units are non-marine, alluvial fan, and stream channel deposits of interbedded gravel, sand, silt, and clay beds. The lower portion of this sequence (correlated with the Livermore Gravels) is more consolidated than the upper portion and is less water-bearing. The upper coarser-grained sand and gravel beds (Quaternary alluvium) have high porosity and permeability and are considered water-bearing and high water-yielding. The upper alluvial deposits range from 30 to 60 feet thick and probably constitute the most significant groundwater aquifer in the project area.

The alluvial sediments fill the valley bottoms of Alameda Creek, Arroyo Hondo, and Calaveras Creek. Data are not available on the depth of these materials upstream of Calaveras Dam and the ACDD, but the general configuration of the topography indicates that they are predominantly shallow stringers of alluvium rather than deep large basins. At Calaveras Reservoir, the valley bottom widens at the southern end of the reservoir and at the confluence with Arroyo Hondo. As a result, a somewhat greater volume of alluvium is present in that area compared to areas upstream or immediately downstream of the reservoir. Downstream of the reservoir, the alluvium is relatively confined to a narrow canyon bottom. Alluvium is approximately 20 feet deep at the site of the proposed replacement dam (URS Corporation 2005a: p. 4-3). The floodplain of

Alameda Creek widens and deepens gradually downstream of the SVWTP down to the Sunol area. From the project site down to the top of Sunol Valley, there are no wells or uses of groundwater along Alameda Creek.

At the Sunol Valley, the valley bottom opens broadly and a wide and deep sequence of alluvial material is present. The area receives runoff and sediments from Alameda Creek as well as the Arroyo de la Laguna. The lower end of the Sunol Valley is confined by bedrock, in effect creating a confined alluvial and groundwater basin.

The upper aquifer in the Sunol Valley is “unconfined,” meaning that the water table fluctuates in response to recharge (precipitation in the wet season) and discharge (evapotranspiration⁶ in the dry season). Significant alluvial deposits have been removed by gravel mining upstream from the location of the former Sunol Dam to the vicinity of the San Antonio Creek confluence with Alameda Creek.

Historical groundwater observations in the Sunol Valley by quarry operators suggest that the majority of groundwater inflow occurs from the upper alluvium within about 50 feet of the ground surface. The water-bearing capability and permeability of the deeper zone, the Livermore Gravels, is lower than that of the shallow alluvium. The contact between the relatively impermeable Livermore Gravels and the highly permeable shallower zone decreases the potential for recharge of the Livermore Gravels via alluvium. Prior to development, groundwater recharge of the Sunol Valley alluvium occurred primarily as seepage from the Alameda Creek stream channel and percolation of direct precipitation. Groundwater levels would have been highest during and just after the rainy season and lowest during summer and until the beginning of the wet season. Discharge from the basin would have consisted primarily of groundwater seepage to the channels of Alameda Creek and Arroyo de la Laguna at the downstream end of the valley (Bookman-Edmondston 1995). Prior to construction of Sunol Dam, which artificially raised the water table, groundwater levels in the downstream end of the valley were lower than those observed today. Sunol Dam was removed in 2006, and that removal is expected to slightly lower groundwater levels in the area. At Sunol, an extensive system of infiltration galleries (along with the Sunol Aqueduct) was constructed in 1900 to capture sub flow of Alameda Creek for use in the SFPUC’s water system. The Sunol Dam was constructed to back-up groundwater and saturate the gravels so that water would flow into the galleries. The galleries had a dependable yield of 5 mgd, but under flood conditions would produce up to 20 mgd (SFPUC 2005c, pp. 11–12). The infiltration galleries remain in place, but following the development of the Hetch Hetchy system, they have a reduced role in the water system. Sunol Dam has been removed, reducing the supply to the galleries. Groundwater in the Sunol infiltration galleries is still collected and may be pumped to San Antonio Reservoir or to the SVWTP.

⁶ The return of water from the soil and from plants to the atmosphere by evaporation and transpiration.

Niles Canyon and Lower Alameda Creek

Downstream of the Sunol Valley, Alameda Creek enters the deeply incised Niles Canyon in which the alluvium is again confined to a narrow stringer of relatively shallow sediments. Upon emerging from the Niles Canyon, Alameda Creek enters the broad and deep basin of the San Francisco Bay plain. Deposition of vast quantities of alluvium carried down Alameda Creek over thousands of years has created the large Niles Cone.

The local hydrogeology in Niles Canyon is best envisioned as occurring in two separate and distinct geological units. The broader and, from a resource perspective, lesser aquifer is contained within the Panoche Formation bedrock. The other aquifer is hosted in alluvial deposits immediately beneath and adjacent to Alameda Creek. The alluvial deposits form the floodplain adjacent to the creek; however, the floodplain is limited in extent by the bedrock slopes of Niles Canyon.

The shallow alluvial aquifer system is well connected to surface water in Alameda Creek. It is reasonable to assume that the amount of groundwater in the shallow aquifer is dependent on the water level in Alameda Creek, and that there is a shallow groundwater gradient directing flow toward Alameda Creek. The shallow groundwater gradient could change on a short-term basis as the limited aquifer responds to precipitation and recharge of shallow groundwater, and as the water level in Alameda Creek fluctuates. The range of seasonal groundwater fluctuation at the site of the former Niles Dam is expected to be about 1–3 feet. The floodplain at Niles Dam was slightly elevated from the water table year round, producing a condition that may help support a riparian community. Niles Dam was removed in September 2006. The removal of this dam is expected to slightly lower groundwater levels.

The bedrock is not considered an aquifer host due to the expected low yields. Furthermore, groundwater in the bedrock would not be strongly influenced by changes and fluctuations in Alameda Creek hydrology, as the hydraulic connection between the two is likely limited.

The Niles Cone Groundwater Basin is an alluvial aquifer system hundreds of feet thick, consisting of unconsolidated gravels, sand, silt, and clay. The gravel and sand deposits have the highest permeability and thus comprise the aquifers, while silt and clay layers have low permeability and form the aquitards. The main point of surface water entry, or recharge, into the Niles Cone Groundwater Basin occurs through Alameda Creek and the percolation ponds. These former gravel quarry pits have been excavated to depths ranging from 70 to 120 feet below ground surface. The main groundwater discharges from the basin are to San Francisco Bay or groundwater extracted for various potable uses by ACWD.

The Hayward Fault divides the Niles Cone Groundwater Basin along an approximate north-south alignment at the foothills of the Diablo Range. An active fault with low permeability, it impedes

the lateral flow of groundwater. Large differences in water levels on either side of the fault demonstrate the relatively impermeable nature of the fault.

Groundwater is extracted from the basin by pumping from ACWD's production and Aquifer Reclamation Program wells and privately-owned wells. Groundwater wells used by ACWD and private owners for water supply generally tap deeper aquifers within the sedimentary sequence. The current and potential beneficial uses of groundwater in the Niles Cone Groundwater Basin are municipal and domestic supply, industrial process supply, industrial service water supply, and agricultural water supply (San Francisco Bay Regional Water Quality Control Board 2003).

Groundwater Quality

Groundwater within the Sunol Valley area is calcium-magnesium bicarbonate water, with concentrations of individual constituents at generally low levels. Total dissolved solids are low (from about 350 to 500 mg/L), as are nitrate concentrations (from 1 to 6 mg/L), with the exception of some localized and elevated nitrate and total dissolved solids concentrations in shallow groundwater due to historical agricultural practices (Bookman-Edmondston 1995).

4.6.1.2 REGULATORY FRAMEWORK

The SFPUC's *Alameda Watershed Management Plan* (2001) recognizes the use of Calaveras Reservoir as a key water storage facility. Protection of Calaveras Reservoir and the watershed lands surrounding it is a key theme in all policies of the Plan. The project would be consistent with the *Alameda Watershed Management Plan* (see Section 4.7, Water Quality). Regulations relevant to hydrology are presented in Section 4.7, Water Quality, and are not repeated here.

1997 California Department of Fish and Game and SFPUC MOU

A 1997 MOU between the SFPUC and CDFG specifies releases from Calaveras Reservoir to improve habitat conditions for native rainbow trout and native warm-water fish species. The SFPUC has not yet begun the program of releases due to delays in constructing a water recapture facility and water storage restrictions placed on Calaveras Dam by the DWR's DSOD (SFPUC 2005a). It is expected that the MOU will provide the foundation for project operations to comply with Fish and Game Code requirements for supporting fish communities downstream of Calaveras Reservoir. The MOU specifies releases from Calaveras Reservoir up to 6,300 AF annually to achieve flow in Alameda Creek immediately downstream of the Calaveras Creek confluence as follows:

- November 1 to January 14 – 5-day running average flow of 5 cfs and minimum flow of not less than 4.5 cfs;
- January 15 to March 15 – 5-day running average flow of 20 cfs and minimum flow of not less than 18 cfs; and

- March 16 to October 31 – 5-day running average flow of 7 cfs and minimum flow of not less than 6.3 cfs.

4.6.2 IMPACTS

4.6.2.1 SIGNIFICANCE CRITERIA

The City and County of San Francisco has not formally adopted significance thresholds related to impacts on hydrology, but generally considers that implementation of the proposed project would have a significant impact on hydrology if it were to:

- Substantially alter streamflows such that they are outside the range of pre-project conditions and result in substantial hydrologic changes;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off the site;
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other authoritative flood hazard delineation map;
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam;
- Expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow;
- Alter streamflow in a manner that would substantially impair channel formation, channel maintenance, or sediment transport functions; or
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).

The proposed project would not include construction of any housing. The project site is located in a rural area with no constructed stormwater drainage systems; potential impacts on water quality of polluted runoff are discussed in Section 4.7, Water Quality. The proposed project is located in an upland location where no tsunami hazard exists. While seiche waves could form on Calaveras Reservoir, the design freeboard would accommodate any estimated run-up and thus would not pose a significant hazard to the safety of the dam. Additionally, the area has restricted public access; therefore, the hazard to the public would be less than significant. The watershed keeper's residence is located on a high bluff upstream of the reservoir and thus would not be

within the reasonable zone of seiche wave runup. The project does not involve construction or operations that would generate mudflows in areas to which the public would be exposed. Construction issues related to geologic conditions and hazards are discussed in Section 4.8, Geology, Soils, and Seismicity. Therefore, issues related to placing housing within a 100-year flood hazard area, as well as seiche, tsunami and mudflow risk are not addressed further in the discussion of impacts in this section. Potential water quality impacts are discussed in Section 4.7, Water Quality.

4.6.2.2 APPROACH TO ANALYSIS

To analyze the impacts of the proposed project on hydrology, a comparison was made between the reservoir water levels, streamflows, and geomorphic and groundwater conditions that would occur with the proposed project and those that would occur if the proposed project were not implemented (the baseline condition). This section describes the methods used to make the comparison and complete the assessment of impacts on hydrology.

Baseline Operating Condition

Since the DSOD imposed restrictions on Calaveras Reservoir in 2001, the SFPUC has altered its operations. Flow diversions to Calaveras Reservoir from upper Alameda Creek have become more intermittent and Calaveras Reservoir levels lowered compared to pre-2001 conditions. The operational conditions prevailing since 2001 are assumed to continue until the Calaveras Dam Replacement Project (CDRP) is implemented, which would restore the historical reservoir capacity. The current operational conditions that are expected to continue until 2014, the target date for reservoir refill to begin, serve as the baseline operating condition for this EIR.

With the exception of geomorphology, this EIR evaluates impacts in relation to the baseline period, with historical data presented for context where applicable. When discussing geomorphology, the impact analysis reviews the historical range of hydrologic conditions from 1925 to 2009, including those that existed before the DSOD restriction, because the existing form of the creek is a result of many years of water system operation, not just the relatively short baseline period (2001 to present).

Analytical Method

Under the first significance criterion listed above, the proposed project would have a significant impact on hydrology if it were to substantially alter streamflows such that they are outside the range of pre-project conditions and result in substantial hydrologic changes. To evaluate this criterion, hydrology was reviewed with respect to changes in the timing and magnitude of flows, the frequency of changes as determined by hydrologic modeling, changes from unimpaired to controlled flow regimes or vice versa, and changes in the total amount of water in the creeks over time.

As described in the setting, hydrology in the Alameda Creek watershed is highly variable from day to day and year to year. Further, reservoir operations vary over time with changes in demand and operating conditions. For these reasons, historical operational and gage data do not provide a sufficient basis for analyzing the baseline hydrologic condition. A hydrologic model was instead used as the primary tool to assess how hydrology would be affected with the implementation of the CDRP, which is standard practice for evaluating water systems. Because the CDRP is part of the greater SFPUC water system, the SFPUC's systemwide model, the Hetch Hetchy Local Simulation Model (HH/LSM), was used to assess how the CDRP would be operated under the baseline, DSOD-restricted condition, and with the proposed project. However, model results were not solely relied upon to evaluate hydrology. Limitations with the modeling required additional analysis, including review of daily and subdaily (15-minute) gage data, as well as review of SFPUC operator experience and knowledge of current and planned operations, to analyze spills and releases at Calaveras Dam and the ACDD.

A general overview of the HH/LSM and the basic assumptions included in the model are described below. Appendix D.1 provides a more detailed description of the model and how it was used for the CDRP impact analysis. It also summarizes the methodology and results of the hydrologic analyses conducted for the CDRP impact assessment. Analysis of gage and operational data are also further discussed below. Appendix D.2 provides supporting details and an explanation of raw data output from the 2018 WSIP model run. Appendix D.3 is a technical memorandum of estimated flow changes in lower Alameda Creek. Appendix D.4 provides additional modeling results and an analysis of flow at the ACDD using 15-minute stream gage data.

Hetch Hetchy/Local Simulation Model

The SFPUC uses the HH/LSM, a computerized mathematical model to assist in the evaluation of its water systems operations (SFPUC 2007). This model is the best available tool for depicting the overall regional water system operations under a range of conditions and is similar to the models used by other water purveyors in the United States to analyze water system operations and to plan for system improvements. The systemwide model must be used to analyze the CDRP because the operation of Calaveras Dam is integrally linked and interdependent with the entire SFPUC water system.

The HH/LSM incorporates detailed information about key aspects of the SFPUC regional water system, including facilities (i.e., reservoir and conveyance capacities) and operating procedures and “rules” that determine how and when water is moved through the system to customers. The operating procedures include responses to seasonal variation in demand, allocation of demand to customer groups, and procedures to maximize the use of local watershed supplies, whereas the rules include responses to regulatory requirements for instream flows and compliance with Raker Act obligations.

The model uses a watershed runoff forecasting routine (for snowmelt and rainfall) that projects the amount of runoff that can be expected to flow into each reservoir (including flows in Arroyo Hondo, Calaveras Creek, and Alameda Creek) for a particular time period. After the amount of runoff is projected, this amount is compared to the availability of reservoir storage and the releases required from the reservoir to meet downstream flow requirements and the diversions needed for water deliveries to SFPUC customers. The model uses a monthly time step. Numerous operational constraints are incorporated, including considerations for treatment plant capacity and water transmission capacity. The HH/LSM assumes that the SFPUC regional water system is operated to maximize the efficient use of local Bay Area watershed runoff and is supplemented with Tuolumne River water resources.

The SFPUC's use of a monthly time-step model such as the HH/LSM is typical of many water systems. For example, the CalSim II model used by the DWR and U.S. Bureau of Reclamation (Reclamation) for statewide water planning is a monthly time-step model. Models with a shorter time-step are not widely developed or used because monthly time-step models are sufficient for most planning purposes. If monthly time-step model output does not reflect a water manager's experience or expectations, the manager may use professional judgment in refining and extrapolating from model results to provide insight into weekly or daily operations.

Monthly time-step models are also often used to prepare CEQA documents. Two examples of CEQA documents that incorporated data from the CalSim II model are the Draft EIR on the Monterey Amendment to the State Water Project Contracts (DWR 2007) and the Environmental Water Account EIS/EIR (DWR and Reclamation 2003).

Simulation of System Operations

The model simulates system operations over the course of an 82-year sequential hydrologic period, from July 1920 through September 2002. The model includes actual, measured historical information about the hydrology (the amount of runoff estimated from snowmelt and/or rainfall) that occurred in each month over the 82-year record. This 82-year period includes many different types and sequences of actual hydrologic conditions, ranging from floods to droughts of different magnitudes and durations. Because natural surface water systems are dynamic and runoff and flow vary each year, and because it is not possible to predict future precipitation, it is a necessary and standard industry practice to use a long-term historical record to represent the range of hydrologic conditions that can be expected in the future. Therefore, the historical record is used in the model to represent the range of hydrologic conditions that could occur in the future. The model is then used to determine how the water system would operate with and without the proposed project under a range of hydrologic conditions.

The HH/LSM uses information on actual historical hydrology but does not "predict" or necessarily precisely depict the past, historical operation of the system. The historical operation

of the system in an actual year will differ from the operations simulated by the model for that year as a result of day-to-day adjustments made by the system operators, who constantly modify operations throughout the year to respond to changing conditions related to weather, demand, water quality, or facilities conditions (e.g., maintenance or unplanned facilities outages). Although many of these factors are built into the model, the model cannot account for all the actual operations and adjustments made throughout each year. The objective of using the HH/LSM is to assess how the current baseline condition would be operated over a number of years and the effect of system changes on future operations over a broad range of realistic hydrologic conditions.

Hydrologic Year Definitions

As described in detail in Appendices D.1 and D.2, all years in the 82 years of historical hydrology were ranked and grouped into hydrologic year types according to unimpaired river and creek flow upstream of the reservoirs. Five hydrologic categories were used to depict the range of wet to dry years, depending on the hydrologic index. A hydrologic year is from October to September. Hydrologic year types are classified by ranking the water years from wettest to driest and grouping them into 20th percentiles, resulting in five year types: wet, above normal, normal, below normal, and dry.

Model Runs Compared for CDRP Analysis

Two model runs were conducted and compared for the impact evaluation. The model runs were similar to those conducted for the WSIP PEIR but reflect the following changes since the WSIP PEIR analysis:

- **MOU Releases:** In the PEIR, with implementation of the CDRP, flow releases consistent with the flow criteria described in the 1997 MOU were met through release from Calaveras Reservoir. As described in the project description, the CDRP will meet MOU flow requirements through the proposed bypass tunnel at the ACDD when water is present, then by release from Calaveras Dam. This change results in less diversion from the ACDD to Calaveras Reservoir under the CDRP than assumed in the WSIP PEIR and an increase in retention of flows from Arroyo Hondo and Calaveras Creek Reservoir.
- **Systemwide Demand:** The analysis of hydrologic impacts for the Alameda Creek watershed in the WSIP PEIR reflected 2030 water demand, which assumed an average annual system demand of 300 mgd. Because the SFPUC adopted the 2018 Phased WSIP variant rather than the originally proposed WSIP, the impact analysis for the CDRP EIR is based on modeling using the 2018 water demand projections, which assumes no increase over existing demand in average annual system demand.
- **ACDD Operations Plan:** The PEIR developed a mitigation measure for the ACDD requiring the development and implementation of an operations plan for the facility requiring that diversion of flow from Alameda Creek to Calaveras Reservoir cease after target storage is achieved in Calaveras Reservoir. The CDRP has incorporated this

mitigation measure into the CDRP project description and is assumed in the HH/LSM modeling.

- **HH/LSM Model Refinements:** The HH/LSM model is periodically refined to provide as accurate an analysis of system operations as feasible with available data. The HH/LSM has undergone minor refinements since the modeling completed for the WSIP PEIR, and those refinements are reflected in the latest modeling efforts.

The two model runs simulate the base, DSOD-restricted condition and the future condition with the CDRP and entire WSIP implemented. The base condition reflects system demand level and operation in 2005. The future condition with the CDRP and WSIP implementation reflects demand and system operation in 2018. In both models, the water demand to be met from local and Hetch Hetchy system reservoirs is the same: 265 mgd. Further detail regarding the model runs is provided in Appendices D.1 and D.2.

Operational Records, Daily Flow Records, and Gage Data

Model results from the HH/LSM were not solely relied upon when evaluating flows in creeks downstream of the dams. The model does not simulate day-to-day variations in reservoir water levels or releases or bypasses to streams but instead provides an average estimate of reservoir water levels and instream flow releases and bypasses in a given month. The HH/LSM does not simulate intermittent phenomena, such as short-term spikes in streamflow following storms or spills and releases from reservoirs that may last only a few days. To more accurately estimate the potential effects of the CDRP on stream flows, average monthly flow estimates derived using the HH/LSM and system operational records were supplemented with the USGS gage data. The additional analysis of the effects of the CDRP on stream flow using gage data is described in Appendix D.4.

Fishery Releases

The SFPUC is proposing to implement flow releases consistent with the flow criteria described in the 1997 MOU to support native fishes in Alameda Creek as part of the proposed project. As further presented in Section 3.6.5, Resident Rainbow Trout Flow Releases, flows would be provided through the proposed ACDD bypass whenever water is present in Alameda Creek and when needed to meet MOU instream flow and temperature criteria. Flow would be augmented with water released from Calaveras Reservoir through the proposed low-flow release valves. These flow releases are included in the modeling performed using the HH/LSM.

For this EIR, it is assumed that the flows for fish habitat enhancement that would be bypassed at the ACDD and released from Calaveras Dam as part of the project are not in exact accordance with the 1997 MOU because the 1997 MOU requires the construction of a recapture facility if flow releases are made, and the proposed project does not include a recapture facility. The SFPUC has incorporated the MOU flow requirements into the proposed project, without the

associated recapture facility, which is planned for a separate project that is in preliminary design and is known as the Upper Alameda Creek Filter Gallery Project (UACFGP). Although construction of the UACFGP is not part of the proposed CDRP, the UACFGP is part of the WSIP as approved by the SFPUC, and the combined impacts of the UACFGP and the CDRP are addressed in Section 6.2, Cumulative Impacts. For these reasons, the analysis of potential impacts on flow in lower Alameda Creek in Appendix D.3 includes recapture of the MOU flows and therefore presents a greater reduction of flows in lower Alameda Creek than would occur under the proposed project. The potential effects of the proposed UACFGP will be evaluated more detail in a separate CEQA document for that project.

In addition to the resident trout flow releases (MOU releases), which were developed to support resident rainbow trout, the SFPUC also proposes to implement flow releases to support steelhead in the watershed in the future when steelhead have regained access above the BART weir as determined by NMFS. SFPUC's proposal related to steelhead is further described in Section 3.6.6, Steelhead Flow Releases, and Section 6.2, Cumulative Impacts. Although the steelhead flow releases also would benefit resident rainbow trout and other native fishes in the watershed, implementation of the majority of these additional flow releases will occur when steelhead regain access above the BART weir, the timing of which depends on actions that are outside of the control of the SFPUC. For purposes of providing a conservative, worst-case disclosure of the potential effects of implementing the CDRP on the hydrology of Alameda and Calaveras Creeks, implementation of the steelhead flow releases is not assumed in the impact analysis below.

Geomorphology and Groundwater

This impact analysis also considers projected changes in sediment transport and geomorphology resulting from the proposed project. This assessment is based on generalized channel bed/bank characteristics and consideration of proposed changes in streamflow that would result from implementing the proposed project. Estimates of monthly streamflows derived from the HH/LSM output are only marginally useful for the assessment of impacts on geomorphology. Channel form and sediment transport are most influenced by peak flows, which the HH/LSM does not estimate. Estimates of peak flows are based on stream gage records.

Information on potentially affected groundwater bodies was obtained from published sources and through interviews with individuals who are knowledgeable about the hydrogeology of the area or involved with groundwater management in the potentially affected area. Impact assessments were performed by reviewing project-induced changes in streamflow and examining their potential to affect groundwater levels or quality.

4.6.2.3 PROJECT IMPACTS

Impacts on hydrology in the Alameda Creek watershed that could result from implementation of the proposed Calaveras Dam project are summarized in Table 4.6.15.

Table 4.6.15: Summary of Impacts – Hydrology in Alameda Creek Watershed

Impact	Level of Significance
Construction Impacts	
4.6.1: Construction of the replacement dam would temporarily change flow rates in Calaveras and Alameda Creeks downstream of Calaveras Dam.	LS
4.6.2: Construction of the replacement dam would temporarily increase downstream flooding risk.	LS
4.6.3: Construction-related activities could affect local groundwater supplies in the vicinity of the dam.	LS
Operational Impacts	
4.6.4: Operational effects on flows in Calaveras Creek downstream of Calaveras Dam.	LS
4.6.5: Operational effects on flow in Alameda Creek downstream of the ACDD to the Calaveras Creek confluence.	LS
4.6.6: Operational effects on flow in Alameda Creek, Calaveras Creek confluence to Arroyo de la Laguna confluence.	LS
4.6.7: Operational effects on flow in Alameda Creek downstream of the Arroyo de la Laguna confluence.	LS
4.6.8: Downstream flooding and hazard in the event of dam failure.	LS
4.6.9: Effects on channel formation and sediment transport along Calaveras Creek.	LS
4.6.10: Effects on channel formation and sediment transport along Alameda Creek downstream of the ACDD to the Calaveras Creek confluence.	LS
4.6.11: Effects on channel formation and sediment transport along Alameda Creek downstream of the Calaveras Creek confluence.	LS
4.6.12: Changes in groundwater levels, flows, quality, and supplies.	LS
<i>Note:</i> LS – Less than significant impact	

Construction Impacts

Impact 4.6.1: Construction of the replacement dam would temporarily change flow rates in Calaveras and Alameda Creeks downstream of Calaveras Dam.

The existing dam would remain in place during construction of the replacement dam. Project construction would require two shutdown periods of the outlet works (mid-April to mid-November of 2011 and 2012 or 2012 and 2013) to allow excavation of the dam foundation and extension of the outlet conduit and to connect a new intake shaft to the outlet conduit. During

this period, no flow would be released to SVWTP or Calaveras Creek from Calaveras Reservoir. Depending on hydrologic year type, this may represent a reduction in flows of Calaveras Creek and downstream (downstream of the confluence) in Alameda Creek compared to existing conditions in similar hydrologic years for the shutdown period. During all other phases of construction, the outlet works would function the same as under existing conditions.

Prior to the outlet works shutdown, the reservoir would be drawn down to an elevation close to the minimum allowable elevation of 690 feet to provide additional storage capacity for rainfall in that period. The hydrologic record shows that on some occasions, releases from the current dam occurred after mid-April each year. On other occasions, all releases were completed by mid-April. The main controlling factor is the annual rainfall conditions. In most years in the Bay Area, little rainfall is expected after April 15 and until October 15. The potential for rainfall occurring in early autumn before November 15 is greater. However, in late summer and early autumn, the reservoir would typically be at its lowest level due to withdrawals to the SVWTP and to evaporation. Because capacity would be available to hold rainfall that might occur in early autumn, releases would not typically occur during this period under baseline conditions, so the absence of releases during the shutdown period is not expected to result in a significant change from baseline conditions. Also, because of withdrawals to the SVWTP in anticipation of the shutdown, if rainfall occurs during the shutdown period, capacity is expected to be available in the reservoir. In the event of rainfall after mid-April, the existing dam would hold and store all water until mid-November, during which time the level of the reservoir may be slightly higher than has occurred during the baseline period. After the shutdown period is terminated, the water would be directed to the SVWTP or released to Calaveras Creek. Thus, releases between mid-November 2011 and mid-April 2012, as well as between mid-November 2012 and mid-April 2013, or the 2012–2013 and 2013–2014 rainy season, may be slightly higher than those under existing conditions in order to draw down Calaveras Reservoir to the DSOD allowed level of Elevation 705 feet, depending on the rainfall in those years. However, releases are expected to be within the range of both baseline and pre-DSOD restriction releases made from the reservoir.

During construction of the CDRP, operation of the ACDD would continue in most years as at present (that is, limited diversion of flow to Calaveras Reservoir depending on rainfall) and thus no impact would occur on flow in Alameda Creek downstream of the ACDD. Similarly, the proposed construction at the ACDD would not alter seepage flow downstream of the ACDD. For the 2 years in which the outlet works shutdown would occur, reduced diversions from the ACDD may be enacted, depending on water level conditions in the reservoir, to ensure that sufficient storage capacity is made available to hold inflow during the summer and early autumn, as noted above. The increased bypass flows would not be expected to have an impact on Alameda Creek downstream of the ACDD.

Construction of the ACDD bypass, as described in Section 3.5.2, Construction of the Alameda Creek Diversion Dam Bypass Facility, in Chapter 3, Project Description, would occur over a 2- to 3-week period during the 4-year CDRP construction period. The construction would occur during summer months when Alameda Creek has very low to no flow. Therefore, the timing and brief duration of the construction of the bypass facility at the ACDD is not expected to alter flows in Alameda Creek downstream of the ACDD during construction. Operation of the new bypass at the ACDD to meet MOU flow requirements would commence upon completion of the CDRP. Operation of the ACDD and the bypass facility after completion of the CDRP is discussed below under operational impacts.

Impact Conclusion

During construction, the proposed project may require an alteration of seasonal flow rates and water levels in Calaveras Reservoir depending on hydrology; however, these would be within the range of past operations and the impact on downstream flow rates would be less than significant.

Impact 4.6.2: Construction of the replacement dam would temporarily increase downstream flooding risk.

As described in Impact 4.6.1, there would be two shutdowns of the Calaveras Dam outlet works during construction (mid-April to mid-November in 2011 and 2012 or 2012 and 2013). During these periods, the existing reservoir outlets and spillway would not be operational, and there would be no means to safely release water from the reservoir, increasing the risk of dam failure. Given that the shutdown would occur mostly during the dry season, the likelihood of a large storm filling the reservoir and resulting in a spill from the dam is extremely low (see discussion under Impact 4.6.1). However, to reduce this risk, the SFPUC proposes to maintain an operational outlet during the rainy season and to lower the reservoir elevation before shutting down the outlet structures to a level that would retain the inflow from a 100-year storm.

When implemented, these safeguards would ensure that the existing dam would operate well within the range established in the DSOD restriction, which was imposed to mitigate flood risk from the existing dam.

Impact Conclusion

By maintaining an operational outlet during the rainy season and drawing down the reservoir to minimal operating levels during construction, the risk of flooding during construction would be reduced to less than significant.

Impact 4.6.3: Construction-related activities could affect local groundwater supplies in the vicinity of the dam.

Dewatering measures may result in localized, short-term lowering of groundwater levels in the vicinity of the dam; however, it does not support local groundwater users. Dewatering would occur primarily during the first 3 years of construction, during excavation and construction of the dam foundations. During this time, dewatering wells, well points, and seepage collection trenches would be used to remove groundwater from the construction site. Extracted groundwater would be treated as needed and discharged to Calaveras Creek downstream of the construction site. Upon completion of the excavated portions of the work, dewatering would cease and groundwater levels would return to pre-construction levels.

Pumping of groundwater in the vicinity of the construction site would draw down groundwater levels below the level of the excavations. Drawdown would be greatest at the point of pumping, and would diminish with distance from the pump. The distance at which the decline in groundwater level would diminish has not been estimated and would be influenced by a number of factors such as geology, aquifer characteristics, and pumping rates. The extent of influence of the groundwater drawdown is expected to be localized and to have minimal impact on groundwater resources outside the immediate vicinity of the construction site, because the wells would be relatively shallow (e.g., approximately 5 feet below the deepest excavation, that is, approximately 30 feet in the Temblor Sandstone and 20–75 feet in the Franciscan Complex, based on proposed excavation depth [see Subsection 3.5.1.2, Excavation and Construction of the Foundation and Embankment, in Chapter 3, Project Description]). The extracted groundwater would be discharged immediately downstream. Based on the stream characteristics of alluvium in Calaveras and Alameda Creeks, the discharged groundwater would be expected to readily infiltrate into the creek bed or contribute to base flow downstream of the construction site, thus contributing to recharge of the local aquifer. Therefore, little net loss of groundwater is expected as a result of these activities. Because the effects of dewatering on shallow groundwater would be temporary and localized, there would be no potential impacts on groundwater supply. Upon completion of the dam and restoration of the higher reservoir, seepage would be restored and groundwater recharge and transmission would resume in the alluvium downstream of the dam.

Groundwater would not be used as a water supply for project construction. Thus, the potential for extraction impacts on groundwater resources would not be applicable to the proposed project.

Impact Conclusion

Impacts on groundwater supplies resulting from construction groundwater dewatering and groundwater recharge would be temporary and local and, thus, less than significant.

Operational Impacts

This section discusses impacts that may occur during the long-term operation of the facilities as proposed as part of the project.

Impact 4.6.4: Operational effects on flows in Calaveras Creek downstream of Calaveras Dam.

At present, streamflow in Calaveras Creek downstream of Calaveras Dam is regulated by the existing dam and reservoir. Flows in this reach of the creek are not reflective of a natural hydrograph but are instead highly dependent on water released from Calaveras Reservoir. Unregulated watershed runoff and seepage beneath and around the dam contribute to flows in this reach of the creek but in a much smaller proportion compared to reservoir releases. Moreover, the proposed project would have no effect on unregulated runoff or estimated dam seepage. Therefore, the following analysis evaluates whether the proposed changes in the timing, frequency, duration, and magnitude of reservoir releases would substantially alter streamflows in Calaveras Creek downstream of the dam such that they would be outside the range of pre-project conditions and result in substantial hydrologic changes.

Cone Valve Releases

Under both existing and proposed operations, water is released from the reservoir through the cone valve to manage reservoir storage levels and for periodic valve testing. Maintaining the reservoir elevation at the DSOD-restricted operating level under the existing condition requires more water to be released through the cone valve than would be required under the proposed project with the reservoir storage capacity restored. Therefore, the proposed project would reduce the frequency and duration of operational releases through the cone valve. Because the rate and volume of flow through the cone valve is limited by the valve's capacity, the magnitude of flow releases through the cone valve would be the same under the proposed project as under existing operations. The timing of operational releases from the cone valve would also remain generally the same under the proposed project (i.e., during periods of high runoff). Under the proposed project, the SFPUC proposes to time cone valve testing to minimize adverse effects on sensitive species (see Section 3.6.3), whereas under the existing conditions, cone valve testing may occur at any time of the year.

Spills

As stated in the Setting section above, uncontrolled releases or spills through the spillway do not occur under the existing conditions because the DSOD requires the reservoir level to be maintained well below the spillway elevation. Under the proposed project, the reservoir water level would be maintained near the elevation of the spillway, and spills would occur during periods of peak runoff when the rate of inflow to the reservoir exceeds the capacity of the cone

valve and the Calaveras Pipeline. Although spills would be infrequent, the proposed project would increase releases to Calaveras Creek resulting from spills compared to existing conditions.

Fisheries Releases

Under existing conditions, no water is released from the reservoir to support fish in Calaveras and Alameda Creeks downstream of the dam. Under the proposed operations, water would be released from the reservoir through the proposed low-flow valves to support native fishes, as discussed in Sections 3.6.5 and 3.6.6. Additional reservoir releases would be provided in accordance with the 1997 MOU flow schedule during any time of the year when sufficient flow is not present in Alameda Creek upstream of the ACDD to meet the MOU flow requirements and in summer when cold water from the reservoir would be released to meet temperature criteria. These fisheries releases are intended to improve habitat conditions for native fish and would increase flows in Calaveras Creek downstream of the dam during times of the year when there is little or no flow in the creek under existing conditions. As previously explained, additional releases to address future steelhead fisheries are not assumed in this hydrology analysis but would occur in the future under the conditions explained in Section 3.6.6, Steelhead Flow Releases, and Section 6.2.3, Cumulative Effects by Environmental Topic.

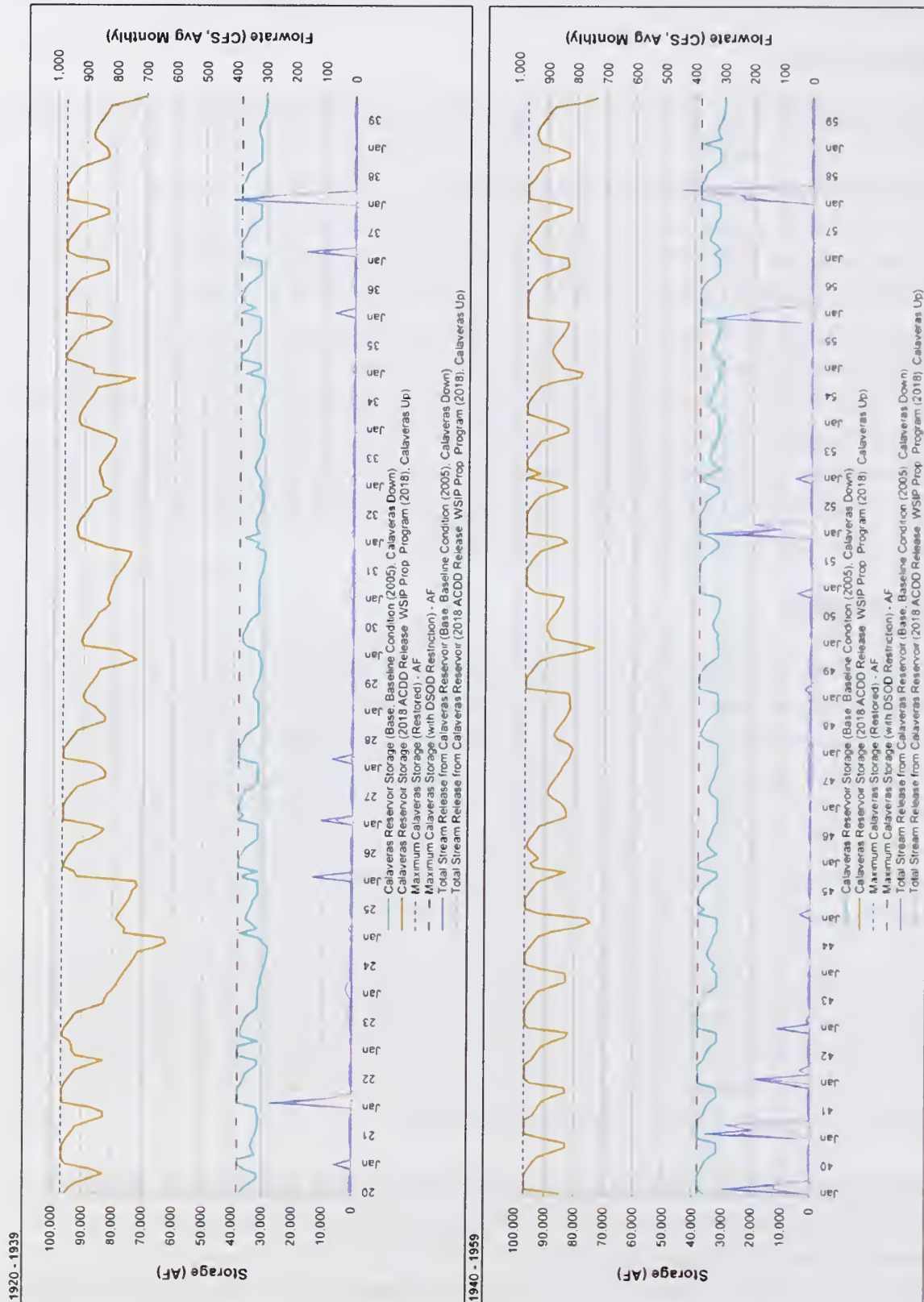
Modeling Results

As further discussed under Approach to Analysis above, the HH/LSM is used to estimate average monthly reservoir releases under both existing operating conditions and under the proposed project. The results of this analysis are shown in Figures 4.6.11a and 4.6.11b and in Tables 4.6.16 and 4.6.17, below. Although changes in monthly average releases are important in evaluating the effects of the proposed project on streamflows downstream of the dam, flows in this reach of the creek are also influenced by short-duration releases that are not depicted by the model. Therefore, this impact analysis also considers gage data and operational records to estimate and compare streamflows under existing and proposed operating conditions.

The main factors that determine the timing, frequency, duration, and magnitude of both controlled and uncontrolled releases from the reservoir are reservoir storage capacity and operating criteria and precipitation in the watershed. Therefore, Figures 4.6.11a and 4.6.11b show the HH/LSM monthly storage in Calaveras Reservoir for the 82-year period of record between 1920 and 2002, under the existing condition and with the proposed project.

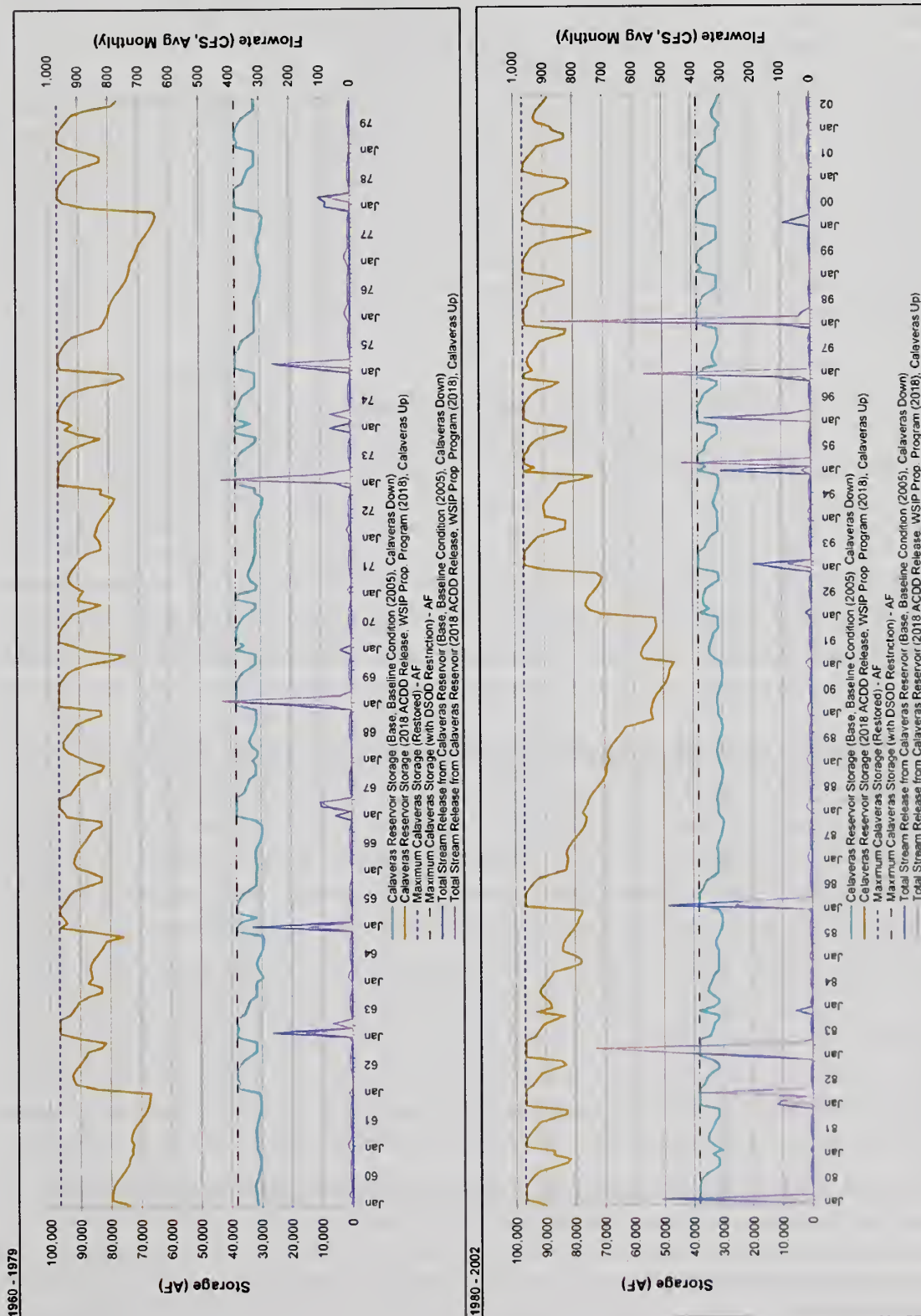
Under existing conditions, reservoir storage fluctuates in a narrow range between 38,100 and 30,000 AF (light blue line in the figures). Under the proposed project, storage would be increased, typically fluctuating between 96,850 and 80,000 AF (orange line in the figures). On relatively rare occasions, typically in extended droughts, the reservoir would be drawn down and

Figure 4.6.11a: Modeled Calaveras Reservoir Storage and Releases to Calaveras Creek, 1920–1959



Source: SFPUC 2009

Figure 4.6.11b: Modeled Calaveras Reservoir Storage and Releases to Calaveras Creek, 1960–2002



Source: SFPUC 2009

Table 4.6.16: Modeled Average Monthly Releases from Calaveras Reservoir to Calaveras Creek (cubic feet per second)

Month	Wet	Above-Normal	Normal	Below-Normal	Dry	All
Existing Condition (2005) ¹						
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	28	3	4	0	0	7
Jan	151	45	6	0	0	40
Feb	297	106	16	0	0	83
Mar	162	50	6	0	0	43
Apr	84	8	0	0	0	18
May	0	0	0	0	0	0
June	0	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
With Proposed Project (2018) ¹						
Oct	7	7	7	7	7	7
Nov	3	3	4	4	5	4
Dec	15	1	2	2	2	4
Jan	81	9	3	3	8	20
Feb	259	54	3	4	12	66
Mar	159	43	2	4	10	43
Apr	84	8	0	1	4	19
May	0	1	2	3	5	2
June	3	4	5	6	6	5
July	6	7	7	7	7	7
Aug	7	7	7	7	7	7
Sept	7	7	7	7	7	7
Difference and Percent Change, Existing Condition (2005) vs. Proposed Project (2018)						
Oct	7	*	7	*	7	*
Nov	3	*	3	*	4	*
Dec	-13	[-46%]	-2	[-67%]	-2	[-50%]
Jan	-70	[-46%]	-36	[-80%]	-3	[-50%]
Feb	-38	[-13%]	-52	[-49%]	-13	[-81%]
Mar	-3	[-2%]	-7	[-14%]	-4	[-67%]
Apr	0	[0%]	0	[0%]	0	[0%]
May	0	[0%]	1	*	2	*
June	3	*	4	*	5	*
July	6	*	7	*	7	*
Aug	7	*	7	*	7	*
Sept	7	*	7	*	7	*

Notes:

* Indicates an increase from zero under current conditions. Detailed information on the HH/LSM and underlying assumptions is provided in Appendix D.1 of this document.

¹ Modeling results do not account for base flows in Calaveras Creek that occur via seepage through and/or around the dam.

Source: SFPUC 2009

Table 4.6.17: Existing and Estimated with-Proposed Project Average Annual Flow in Calaveras Creek Downstream of Calaveras Dam

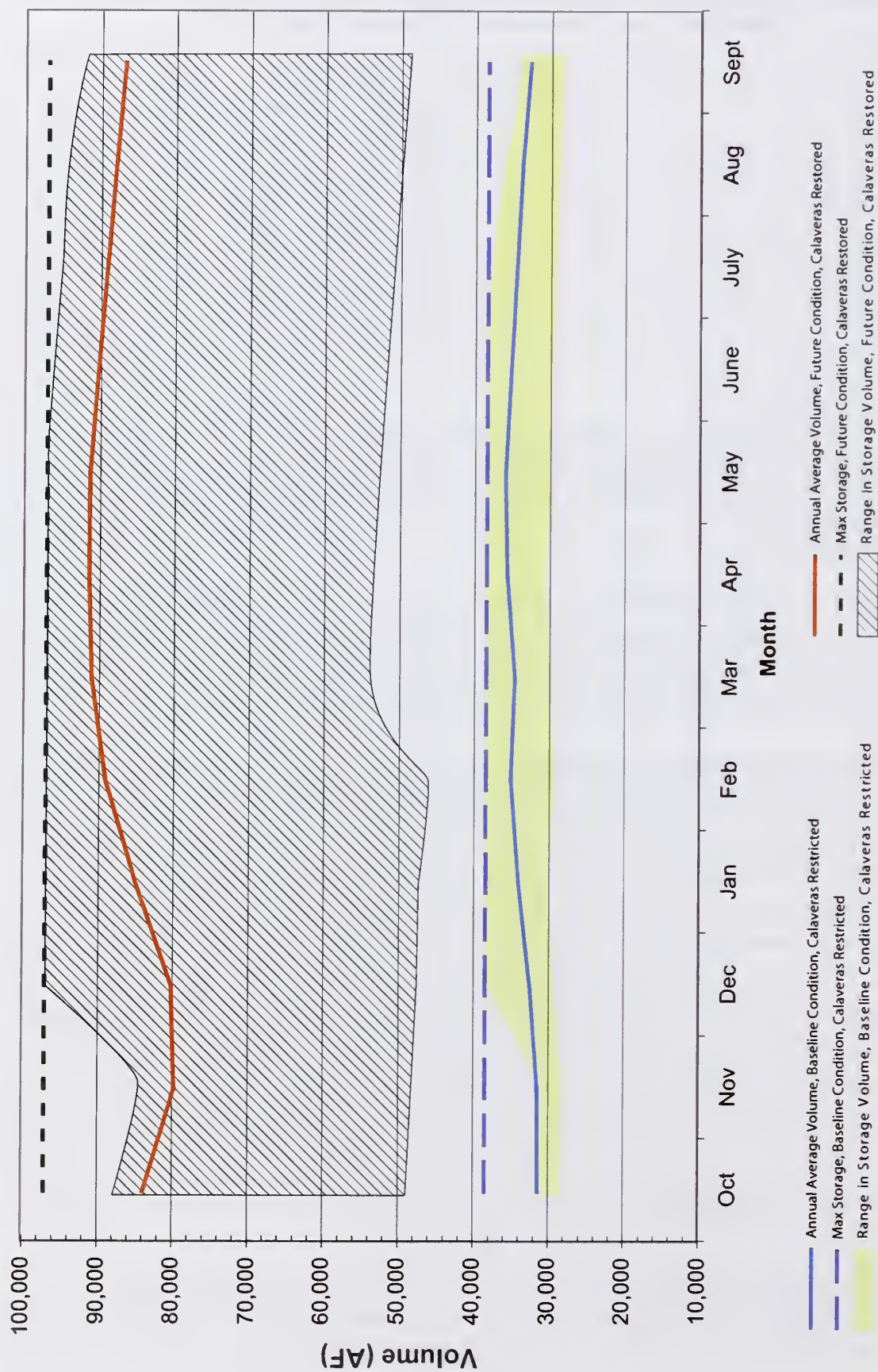
	Flow (AFY) ¹		Difference (Proposed Project - Baseline)	
	Existing	Proposed Project		
Wet	42,622	37,191	-5,432	-13%
Above-normal	12,423	8,851	-3,572	-29%
Normal	1,831	2,924	1,093	60%
Below-normal	0	3,205	3,205	*
Dry	0	4,826	4,826	*
All years	11,249	11,268	19	0.002%
Notes: AFY = acre-feet per year. * Indicates an increase from zero under current conditions. Detailed information on the HH/LSM and underlying assumptions is provided in Appendix D.1 of this document. ¹ Modeling results do not account for base flows in Calaveras Creek that occur via seepage through and/or around the dam.				

Source: SFPUC 2009

storage would fall below 80,000 AF. Figures 4.6.11a and 4.6.11b show that unusually large drawdowns would occur in drought conditions—for example, the conditions that occurred from 1975 through 1977 and in the early 1990s. Figure 4.6.12 shows average annual operating levels and the range of reservoir operation during existing and with-project conditions.

Figures 4.6.11a and 4.6.11b show estimated monthly releases and spills from Calaveras Reservoir for the 82-year period of record between 1920 and 2002 under the existing condition (dark blue line in the figures) and with the proposed project (purple line in the figures). As can be seen in the figures, noticeable peaks in average monthly releases are generally discernable when they reach or exceed about 100 cfs. The figures show that under the existing condition, average monthly wintertime releases of 100 cfs or more would occur in 28 years of the 82-year hydrologic record (flows greater than 100 cfs are representative of large flow events). Under the proposed project, average monthly wintertime releases of 100 cfs or more would occur in 23 years of the 82-year hydrologic record, but the releases would usually be of smaller volume than under the existing condition. Unlike under existing conditions, however, higher minimum flows up to 7 cfs would occur at other times of year, particularly summertime, to satisfy the fisheries flow releases requirement of up to 7 cfs (see Sections 3.6.5 and 3.6.6). This would result in an increase in flow over the base flows (estimated at approximately 0.5 cfs) that are currently provided by seepage through and around the dam.

Another way to view the change in releases is shown in Table 4.6.16, which summarizes estimated monthly average releases to Calaveras Creek downstream of Calaveras Dam for the 82-year period of record by month and year type. Under the existing condition, there are no releases



SOURCE: SFPUC 2009

CALAVERAS DAM REPLACEMENT PROJECT

FIGURE 4.6.12: MODELED STORAGE IN CALAVERAS RESERVOIR, ANNUAL AVERAGE AND RANGE IN STORAGE VOLUME

to Calaveras Creek in dry and below-normal years. Beyond nominal seepage, there is no flow in the creek between April and November in normal years and no flow between May and November in wet and above-normal years, but considerable flow in winter and early spring.

Under the proposed project, monthly average flows in Calaveras Creek downstream of Calaveras Dam between December and March would be reduced by 2 percent to 81 percent in wet, above-normal, and normal years but would be increased from the current nominal seepage flow (assumed to be zero in supporting tables) in below-normal and dry years. As noted above, under the existing conditions, Calaveras Creek downstream of Calaveras Dam is dry (except for nominal seepage) between May and November in all year types. Under the proposed project, there would always be some water released to the creek in these months because of fishery releases.

An annualized summary of the information presented in Table 4.6.16 is presented in Table 4.6.17, which shows the estimated annual average volume of water released to Calaveras Creek downstream of Calaveras Dam in different year types under the existing condition and with the proposed project. The proposed project would decrease the annual average volume of water released to Calaveras Creek in wet and above-normal years by 13 percent and 29 percent, respectively, and it would increase the annual average volume of water released to the creek in normal years by 60 percent. Although flow in some months of normal years would be reduced, as noted above, the reductions would be more than offset by increases in flow in other months. In below-normal and dry years, an annual average of between 3,200 and 4,820 AF would be released to the creek; under the existing condition, no water would be released to the creek in these year types.

The proposed project would have almost no effect on long-term annual average flows, resulting in about the same volume of releases under baseline and project conditions when all year types are considered together over the modeled historical period. Under the existing condition, long-term annual average flows in Calaveras Creek downstream of Calaveras Dam are 11,249 AF; with the proposed project, they would be 11,268 AF.

Impact Conclusion

The baseline flows in Calaveras Creek are not reflective of a natural hydrograph but instead are highly dependent on releases from the dam. As shown above, the proposed project would not substantially alter streamflows in Calaveras Creek downstream of the dam such that they would be outside the range of pre-project conditions and result in substantial hydrologic changes. Under the proposed project, streamflows in Calaveras Creek would be regulated in substantially the same manner as under existing conditions. Flows would be highest in the winter months of wetter years and lowest in the summer months of all years and the winter months of drier years. Peak flows would be the same or greater than under the existing condition, and minimum base

flows would be increased in all years. Overall, long-term annual average releases to Calaveras Creek would be nearly the same with the project as under baseline conditions. Thus, the proposed project would have a less-than-significant impact on the hydrology of Calaveras Creek.

Impact 4.6.5: Operational effects on flow in Alameda Creek downstream of the ACDD to the Calaveras Creek confluence.

Under existing conditions, streamflow in Alameda Creek below the ACDD is regulated by the existing diversion dam and tunnel. Flows in this reach of the creek are not reflective of a natural hydrograph but are instead highly dependent on operation of the ACDD. Unregulated watershed runoff and seepage beneath and around the ACDD contribute to flows in this reach of the creek but in a much smaller proportion compared to water flowing over the ACDD when the diversion gate is closed or when flow in Alameda Creek upstream of the ACDD exceeds the 650 cfs capacity of the diversion tunnel. The proposed project would not alter the ACDD so as to affect seepage or unregulated runoff. Consequently, the following analysis focuses on whether proposed changes in operation of the ACDD would substantially alter streamflows in the reach of Alameda Creek between the ACDD and the Calaveras Creek confluence such that they would be outside the range of pre-project conditions and result in substantial hydrologic changes.

Diversion Dam Operations

The SFPUC diverts water from Alameda Creek to Calaveras Reservoir by opening the diversion gates at the ACDD to convey water through the diversion tunnel to the reservoir. When the gates are open, all of the flow of Alameda Creek up to 650 cfs is diverted through the tunnel to the reservoir. When the gates are closed, the entire flow of the creek spills over the diversion dam and continues down Alameda Creek.

Flow in upper Alameda Creek is flashy, responding rapidly to rainfall over its watershed. As rain falls over the watershed, flow in the creek increases steeply, reaches its peak, and declines rapidly as the storm passes. High flow in the creek may last for only a few hours depending on the duration of the storm. In some storms, flow in the creek may exceed the capacity of the tunnel. If the diversion tunnel is open at such times, 650 cfs is diverted to the reservoir, and the remainder of the flow in excess of the 650 cfs capacity of the diversion tunnel spills over the ACDD and continues down Alameda Creek.

The proposed project would increase the water storage capacity of Calaveras Reservoir as described above in Impact 4.6.4. The increased storage capacity would allow more water from Alameda Creek to be stored in the reservoir than under the existing DSOD-restricted storage level. With the proposed project, on average, the reservoir would be kept fuller for longer periods than under pre-DSOD restricted conditions. The ACDD Operations Plan will direct that the Diversion Dam and Tunnel be operated to pass flows down Alameda Creek (close diversion tunnel gates) when diversion of flow is not required to maintain desired reservoir levels.

Fisheries Bypass Releases

Under existing conditions, there is no mechanism allowing water in Alameda Creek to bypass the ACDD, and the diversion gate is designed to be operated either fully opened or fully closed. When the diversion gate is opened, all flow up to 650 cfs is diverted from the creek. As part of the proposed project, the SFPUC proposes to construct a bypass tunnel at the ACDD to enable flows to bypass the ACDD even when the gate to the diversion tunnel is open. As specified in Sections 3.6.5 and 3.6.6, when water is present in upper Alameda Creek, a portion of the flow would be allowed to bypass the ACDD to support native fishes in the creek downstream of the diversion dam.

Modeling Results

As previously explained, the HH/LSM was used to estimate average monthly flows at the ACDD. Figures 4.6.13a and 4.6.13b show estimated monthly bypasses and spills at the ACDD for the 82-year period of record, between 1920 and 2002, under the existing condition (dark blue line in the figures) and with the proposed project (pink line in figures). The figures show that under the existing condition, average monthly wintertime spills of 100 cfs or more would occur in 33 years of the 82-year hydrologic record. With the proposed project in place, average monthly wintertime spills of 100 cfs or more would occur in 28 years of the 82-year hydrologic record; in some years, the spills would be smaller in volume than under the existing condition, and in other years, fairly similar.

Although not clearly visible in the figures, the proposed fisheries bypass releases at the ACDD would provide minimum flows in Alameda Creek downstream of the diversion dam more of the time than under the existing conditions.

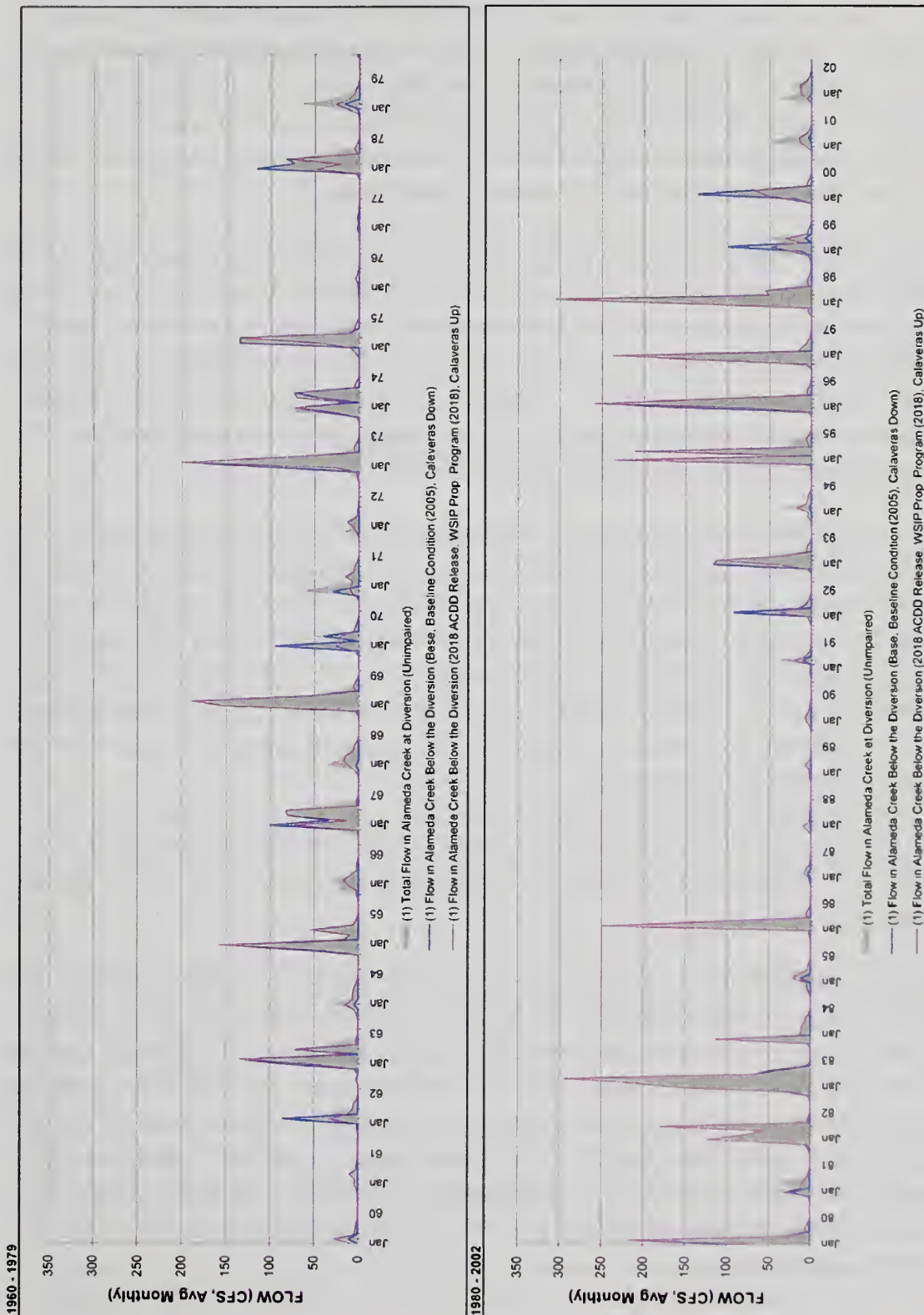
Analysis of modeled flows downstream of the ACDD reveals that flows would be decreased in at least one month in 31 out of the 82 years, or about 38 percent of years. The total water passing the ACDD and continuing down the creek would decrease in 22 out of 82 years (27 percent) and increase in 60 of the 82 years (73 percent). Of the 31 years with reductions in at least one month of flow, 21 have just one month with reduced flow, nine have two months of reduced flow, and one has three months of reduced flow. Overall, there are 42 months out of the 984 months modeled with decreases in flow. In contrast, flows would increase in 851 out of the 984 months modeled; however, in most cases, the increases in flow are small compared to the months with decreased flows. In remaining 91 months there would be no change in flow from the base condition. This is because most increases are attributable to lower flows bypassing the ACDD to meet the proposed fisheries flow release schedules. Tables presented in Appendix D.2 provide further detail of these changes in flow at ACDD.

Figure 4.6.13a: Modeled Flows in Alameda Creek Downstream of the ACDD, 1920–1959



Source: SFPUC 2009

Figure 4.6.13b: Modeled Flows in Alameda Creek Downstream of the ACDD, 1960–2002



Source: SFPUC 2009

Another way to understand the change in spills and bypasses at the ACDD is shown in Table 4.6.18, which summarizes estimated monthly average flows in Alameda Creek downstream of the diversion dam for the 82-year period of record by month and year type. Under the existing condition, there is little or no flow in Alameda Creek downstream of the diversion dam in dry and below-normal years. There is no flow in the creek downstream of the diversion dam between May and November in normal and above-normal years and no flow between June and November in wet years, but considerable flow in the winter and early spring.

Under the proposed project, monthly average flows in Alameda Creek downstream of the ACDD between December and February would be reduced by 11 percent to 31 percent in above-normal and normal years but would be increased in below-normal and dry years. In wet years, flows would be increased by 9 percent in December, decreased by 8 percent in January, and unchanged from the existing condition in February. As noted above, under the existing condition, Alameda Creek downstream of the diversion dam is dry in some months of all year types. With the proposed project, the creek would be dry in fewer months.

Table 4.6.19 shows the estimated annual average volume of water that flows down Alameda Creek downstream of the ACDD in different year types under the existing condition and with the proposed project. The proposed project would decrease the annual average volume of water flowing down Alameda Creek in above-normal and normal years by 8 percent and 3 percent, respectively, and it would increase the annual average volume of water flowing down the creek in wet years by 2 percent. In below-normal and dry years, an annual average of between 3,013 and 1,585 AF would flow down the creek, a volume 665–2,633 percent greater than would flow down the creek under the existing condition.

Under the existing condition, long-term average flows in Alameda Creek downstream of the diversion dam are 8,842 AFY; with the proposed project, they would be 9,494 AFY, an increase of 7 percent.

In summary, implementing the proposed project would alter the pattern of flow in Alameda Creek downstream of the diversion dam by decreasing monthly average flows in December through February of above-normal and normal years and January of wet years and increasing or resulting in no change to flows in other months of those and other year types. The decrease in wintertime flow in above-normal and normal years is attributable to restoration of the capacity of Calaveras Reservoir, which would enable the SFPUC to capture a greater proportion of runoff from upper Alameda Creek during these months and year types. The increase in flow at other times is attributable to proposed fisheries releases made from the diversion dam and implementation of the ACDD operations plan.

Table 4.6.18: Estimated Average Monthly Flow in Alameda Creek Downstream of the ACDD (cubic feet per second)

Month	Wet		Above-Normal		Normal		Below-Normal		Dry		All	
Existing Condition (2005)												
Oct	0		0		0		0		0		0	
Nov	0		0		0		0		0		0	
Dec	22		18		16		0		0		11	
Jan	113		60		14		1		0		37	
Feb	145		94		33		2		1		55	
Mar	94		50		15		4		0		32	
Apr	50		12		2		0		0		13	
May	2		0		0		0		0		0	
June	0		0		0		0		0		0	
July	0		0		0		0		0		0	
Aug	0		0		0		0		0		0	
Sept	0		0		0		0		0		0	
With Proposed Project (2018)												
Oct	0		0		0		0		0		0	
Nov	1		1		0		1		0		1	
Dec	24		16		11		3		2		11	
Jan	104		42		11		9		5		34	
Feb	145		73		24		14		8		53	
Mar	96		56		18		14		6		38	
Apr	52		19		7		5		3		17	
May	7		5		4		4		2		4	
June	3		2		1		1		1		2	
July	1		0		0		0		0		0	
Aug	0		0		0		0		0		0	
Sept	0		0		0		0		0		0	
Difference and Percent Change, Existing Condition (2005) vs. Proposed Project (2018)												
Oct	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Nov	1	*	1	*	0	[0%]	1	*	0	[0%]	1	*
Dec	2	[9%]	-2	[-11%]	-5	[-31%]	3	*	2	*	0	[0%]
Jan	-9	[-8%]	-18	[-30%]	-3	[-21%]	8	[800%]	5	*	-3	[-8%]
Feb	0	[0%]	-21	[-22%]	-9	[-27%]	12	[600%]	7	[700%]	-2	[-4%]
Mar	2	[2%]	6	[12%]	3	[20%]	10	[250%]	6	*	6	[19%]
Apr	2	[4%]	7	[58%]	5	[250%]	5	*	3	*	4	[31%]
May	5	[250%]	5	*	4	*	4	*	2	*	4	*
June	3	*	2	*	1	*	1	*	1	*	2	*
July	1	*	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Aug	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]
Sept	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]	0	[0%]

Note:

* Indicates an increase from zero under current conditions. Detailed information on the HH/LSM and underlying assumptions is provided in Appendix D.1 of this document.

Source: SFPUC 2009

Table 4.6.19: Existing and Estimated with-Proposed Project Average Annual Flow in Alameda Creek Downstream of the ACDD

	Flow (AFY)		Difference (Proposed Project – Baseline)	
	Existing	Proposed Project		
Wet	25,331	25,731	400	2%
Above-normal	13,911	12,734	-1,177	-8%
Normal	4,731	4,611	-120	-3%
Below-normal	394	3,013	2,619	665%
Dry	58	1,585	1,527	2,633%
All years	8,842	9,494	652	7%
<i>Note:</i> AFY = acre-feet per year.				

Source: SFPUC 2009

As noted earlier, the HH/LSM is a monthly time-step model. Because upper Alameda Creek is a flashy stream with flow rising and falling rapidly in a few hours or days, the HH/LSM simulation of diversion of water to Calaveras Reservoir from Alameda Creek is not able to depict daily and hourly peak flows that have an important influence on the hydrologic conditions of Alameda Creek. Thus, the analysis below considers daily and 15-minute stream gage data and the knowledge and experience of the SFPUC's water system operators to provide a more detailed picture of how the proposed project would affect flows in Alameda Creek downstream of the ACDD.

Peak Flows

Specific analysis of peak flows below the ACDD was conducted using 15-minute gage data in combination with data generated by the HH/LSM. Fifteen-minute flow data were obtained from USGS for the gage on Alameda Creek above the ACDD, which records unimpaired flow into the diversion dam. Gage data are available for the period from October 1994 to July 2009. The data showed 6 months with substantial peak flows, in which average monthly flows were around 7,300 AF. The HH/LSM data were then analyzed for a representative year in which no diversion was made in the base condition and diversion would be implemented in the future condition. February 1926 was chosen from the modeled data because it fulfilled these criteria and because the total modeled monthly inflow (7,300 AF) was similar to total monthly flows gaged on Alameda Creek within the available 15-minute gage record. A mathematical model was then developed using the data from the representative month (February 1926) that routed flows either through the diversion tunnel to Calaveras Reservoir or down the stream through the bypass or via spill over the diversion dam during high flows. The 6 months of recent gage data with average monthly flows around 7,300 AF were then analyzed with the mathematical model to see how each of these particular peak flows would have been routed under the proposed project (either through the diversion tunnel to Calaveras Reservoir or down the stream through the bypass or via

spill over the diversion dam) had they occurred in the representative month. The results of this analysis are presented in Figure 4.6.14a: Analysis of 15-Minute USGS Gage Data from Alameda Creek above the ACDD and Flow Past the Dam (March 1996, December 1996, February 1999), Figure 4.6.14b: Analysis of 15-Minute USGS Gage Data from Alameda Creek above the ACDD and Flow Past the Dam (February 2000, December 2002, March 2006), and detailed further in Appendices D.2 and D.4.

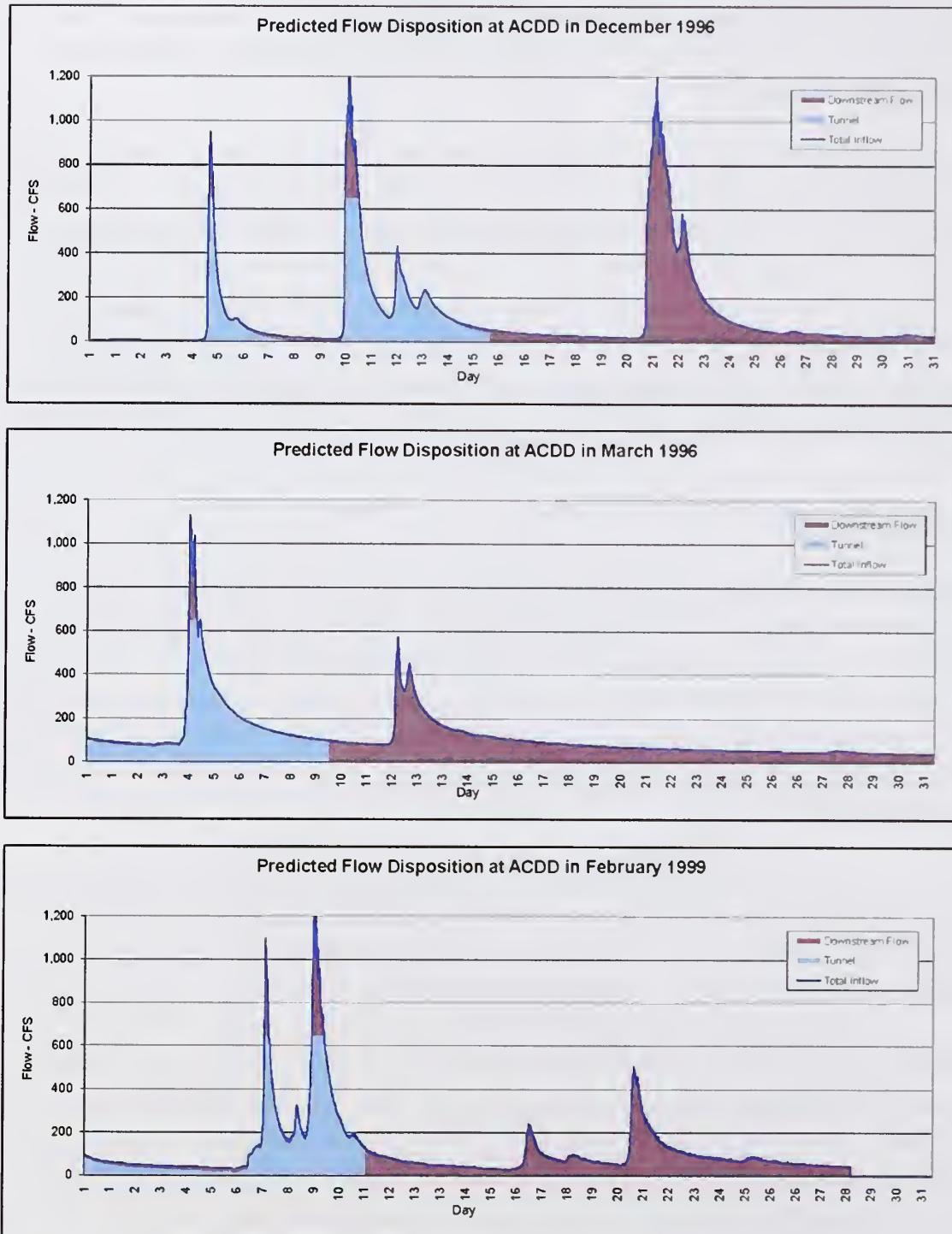
Figures 4.6.14a and 4.6.14b show that flow would be partly diverted into the tunnel and would partly spill to the creek downstream of the ACDD under the proposed project. The light blue-colored portions of the figures show water diverted to Calaveras Reservoir through the tunnel (“Tunnel”). The red-colored portions show water that spills over the ACDD (“Downstream Flow”) due to flows greater than 650 cfs (during diversions), due to bypass for fishery flows, or all flows during periods when diversion is not required and the diversion gates are closed in accordance with the ACDD Operations Plan. The illustrations show that in 3 of the 6 months modeled, peak flows spilling over the ACDD are as great as or greater than peak flows diverted to the tunnel.

Impact Conclusion

Under existing conditions, streamflow in Alameda Creek downstream of the ACDD is not reflective of a natural hydrograph but instead is highly dependent on operation of the ACDD. As shown above, the proposed project would not substantially alter streamflows in Alameda Creek downstream of the ACDD such that they would be outside the range of pre-project conditions and result in substantial hydrologic changes. Under the proposed project, the flow regime in Alameda Creek downstream of the ACDD with the proposed project would be substantially similar to the modeled baseline flow regime.

Wintertime diversions from Alameda Creek to Calaveras Reservoir through the tunnel in above-normal and normal years would increase. Wintertime flows in Alameda Creek downstream of the diversion dam in above-normal and normal years would correspondingly decrease compared to the existing condition. However, the change in Alameda Creek flows downstream of the ACDD in these year types would not change substantially. In above-normal years, average annual flows would be reduced by about 8 percent and in normal years about 3 percent; in those months of reduced flow (December, January, and February), the creek would still experience comparatively large flows. In wet years, where storm events are more frequent, less diversion would typically be required from the ACDD to maintain target reservoir levels, and large spills would occur. Average monthly flow in January of wet years would be reduced by 8%; however, average annual flows in Alameda Creek in wet years would increase by about 2 percent. Summertime flows in all year types and wintertime flows in below-normal and dry year types would be the same or greater with the proposed project than under the existing condition.

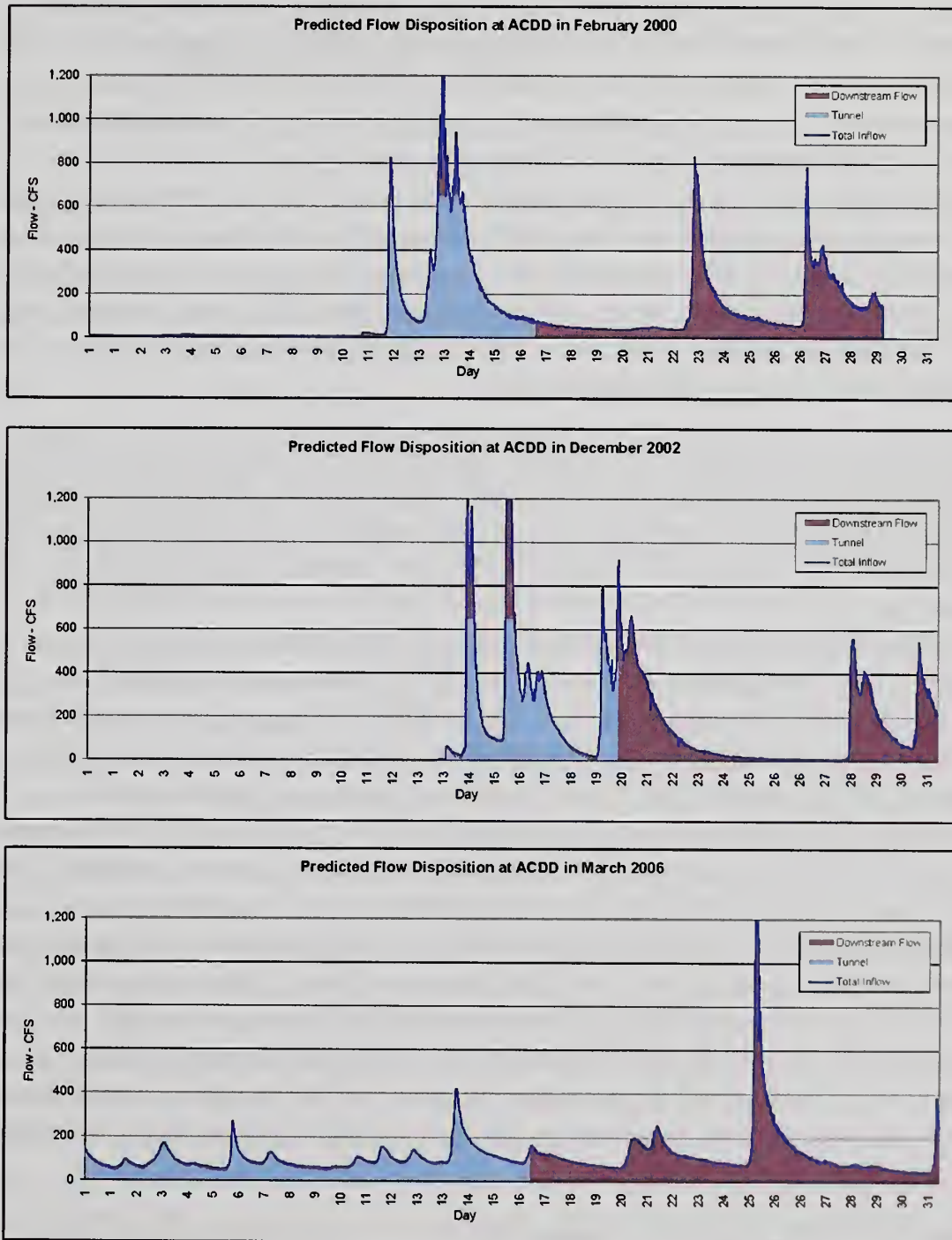
Figure 4.6.14a: Analysis of 15-Minute USGS Gage Data from Alameda Creek above the ACDD and Flow Past the Dam (March 1996, December 1996, and February 1999)



Note: Predicted flow disposition based on February 1926 modeled operations

Source: Steiner 2009

Figure 4.6.14b: Analysis of 15-Minute USGS Gage Data from Alameda Creek above the ACDD and Flow Past the Dam (February 2000, December 2002, and March 2006)



Note: Predicted flow disposition based on February 1926 modeled operations

Source: Steiner 2009

As now, flows downstream of the ACDD would be greatest in the winter months of wetter years, and flows would be small or nonexistent in the summer months of all years and the winter months of drier years. Peak flow spills, although reduced in some months or portions of months, would still occur at other times, similar to baseline conditions, as shown by the modeling of several months of 15-minute peak flow gage data. The number of months when completely dry conditions occur in Alameda Creek downstream of the diversion dam would be reduced with the proposed project. The proposed project would not substantially change the range of flows in Alameda Creek downstream of the diversion dam, with the exception of the elimination of completely dry conditions in many months, which would be beneficial, and the passage of peak flow events due to implementation of the ACDD Operations Plan. Modeling over all year types, in the long term, shows that the proposed project would increase total flows in Alameda Creek by about 7 percent. This is largely the result of substantial increases in flows in below-normal and dry years. Thus, the proposed project would have a less-than-significant impact on flow in Alameda Creek downstream of the diversion dam.

This significance determination differs from the determination of a significant and unavoidable impact on hydrology in the WSIP Final PEIR (WSIP Impact 5.4.1-2). The primary reason for the difference is that with the proposed project as currently configured, more water would flow down Alameda Creek downstream of the diversion dam than was assumed to be the case with the proposed project as configured in the WSIP PEIR. The project as now proposed includes an ACDD Operations Plan and contains a bypass component and operational feature in which fisheries releases would be made from the proposed ACDD bypass rather than solely from Calaveras Reservoir as assumed in the PEIR. The HH/LSM modeling analysis presented above accounts for these project changes. In the WSIP PEIR, the HH/LSM modeling, which did not assume an ACDD Operations Plan, a bypass structure or the bypass of fisheries releases downstream of the ACDD, predicted an overall decrease in flows below the ACDD of 14 percent. Further, in the WSIP PEIR analysis, flows were reduced in wet, above-normal, and normal years. Flows in below-normal and dry years under the WSIP PEIR analysis were unchanged. As explained above, under the proposed project as now configured, only flows in above-normal and normal years and one month in wet years show a reduction in flows; in other year types the flows would be the same or increase and overall average annual flows increase by 7 percent. As shown by the analysis above, with the ACDD Operations Plan and the fisheries releases through the proposed ACDD bypass tunnel, the proposed project would not substantially alter stream flows such that they are outside the range of pre-project conditions and result in substantial hydrologic changes in this reach of the creek.

Further, the WSIP PEIR analysis assumed that peak flows from major storms would resemble those currently occurring during much smaller storm events and that smaller storms would not result in any flows at all. The HH/LSM modeling and the assessment of peak flow events using the USGS 15-minute gage data along with results from the HH/LSM present a more refined

picture of what would occur downstream of the ACDD during peak flow events. For all the above reasons, the impact of the proposed project on streamflows in this reach of Alameda Creek would be less than significant.

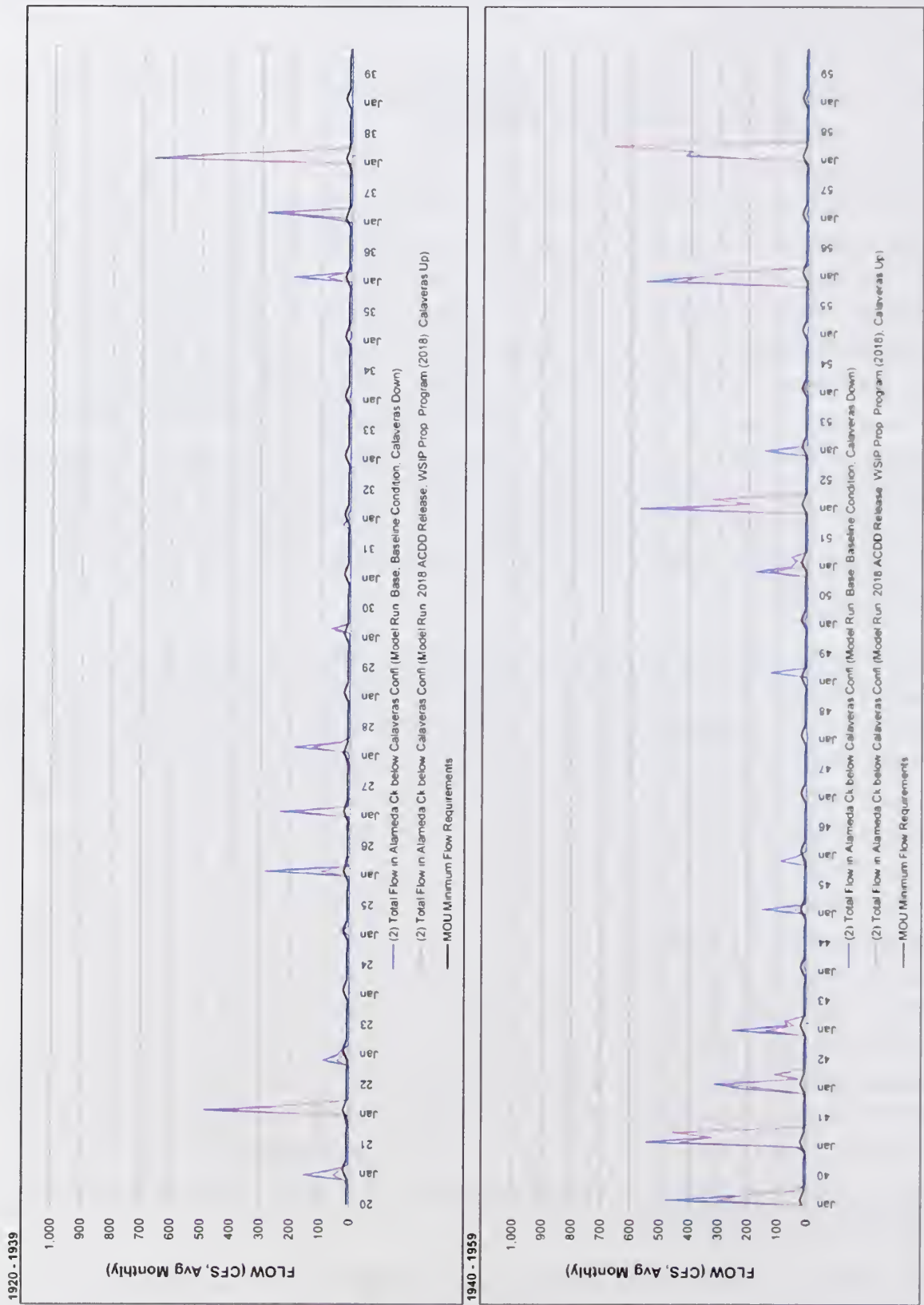
Impact 4.6.6: Operational effects on flow in Alameda Creek, Calaveras Creek confluence to Arroyo de la Laguna confluence.

Flow immediately downstream of the confluence of Alameda and Calaveras Creeks is the sum of flow in the two creeks upstream of the confluence. Under existing conditions, streamflow in Alameda Creek downstream of the Calaveras Creek confluence is regulated by Calaveras Dam and the ACDD. Flows in this reach of the creek are not reflective of a natural hydrograph but are instead highly dependent on operation of the ACDD and the dam. Unregulated watershed runoff and seepage beneath and around Calaveras Dam and the ACDD contribute to flows in this reach of the creek but in a much smaller proportion compared to water released from Calaveras Reservoir and spilling over the ACDD. Because the proposed project would have no effect on unregulated runoff and estimated seepage, the following analysis evaluates whether the proposed changes in operation of Calaveras Dam and the ACDD would substantially alter streamflows in the reach of Alameda Creek between the Calaveras Creek confluence and Arroyo de la Laguna such that they would be outside the range of pre-project conditions and result in substantial hydrologic changes.

Implementation of the proposed project would alter flow in Calaveras Creek downstream of Calaveras Dam and in Alameda Creek downstream of the ACDD, as described above for Impacts 4.6.4 and 4.6.5. To summarize, the project would restore storage capacity in Calaveras Reservoir. As a result, it would be possible to capture more water from Alameda Creek, Arroyo Hondo, and Calaveras Creek in the reservoir. Releases from Calaveras Dam into Calaveras Creek would be reduced in winter months (December through March) of wet, above-normal, and normal years. Flows below the ACDD into Alameda Creek would be reduced in winter months (December through February) of above-normal and normal years and January of wet years. However, the proposed fisheries flow release from ACDD and Calaveras Dam would increase summer flow in Alameda Creek downstream of the diversion dam and in Calaveras Creek downstream of Calaveras Dam in all year types. Implementation of the ACDD Operations Plan will also increase flows during some periods below ACDD. Over all year types, the releases below the Calaveras Dam to Calaveras Creek would approximately equal existing releases and flows below the ACDD would increase by about 7 percent. Because implementing the proposed project would alter flow in Calaveras Creek downstream of Calaveras Dam and in Alameda Creek downstream of the diversion dam, it would also alter flow in Alameda Creek downstream of its confluence with Calaveras Creek.

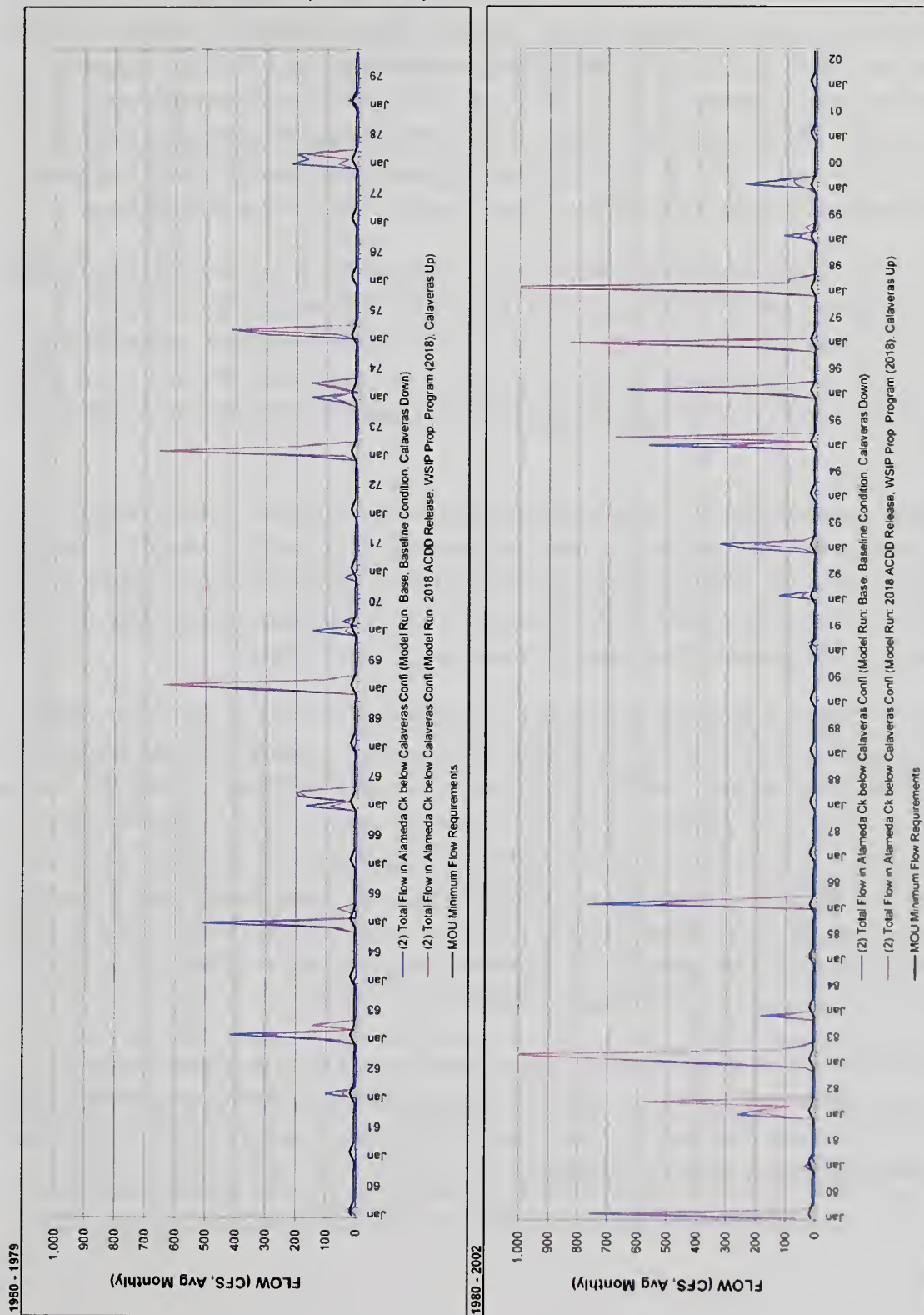
Figures 4.6.15a and 4.6.15b show estimated monthly average flows in Alameda Creek downstream of its confluence with Calaveras Creek for the 82-year period of record under the

Figure 4.6.15a: Modeled Flow in Alameda Creek Downstream of the Calaveras Creek Confluence (1920–1959)



Source: SFPUC 2009

Figure 4.6.15b: Modeled Flow in Alameda Creek Downstream of the Calaveras Creek Confluence (1960–2002)



Source: SFPUC 2009

existing condition and with the proposed project in place. The estimated monthly average flows include releases and spills from Calaveras Dam and the ACDD and flow produced by unregulated runoff into the two creeks between the dams and the confluence. Under the existing condition, spills and releases from Calaveras Dam, spills and releases from the ACDD, and unregulated runoff contribute an average of 11,249, 8,842, and 1,919 AFY to flow at the confluence, respectively. The corresponding average values with the proposed project in place would be 11,268, 9,494, and 1,919 AFY. Thus, the proposed project would result in a small increase in overall annual flow, with a minor effect on the proportion of total flow at the confluence.

Table 4.6.20 summarizes monthly average flows in Alameda Creek downstream of its confluence with Calaveras Creek for the 82-year period of record by month and year type. Under the existing condition, there is little or no flow in Alameda Creek downstream of the confluence in most months of dry and below-normal years. There is little or no flow in the creek in wet, above-normal, and normal years between June and November, but considerable flow in the winter and spring.

With the proposed project in place, monthly average flows in Alameda Creek downstream of its confluence with Calaveras Creek between December and March would be reduced by 1 percent to 47 percent in wet, above-normal, and normal years but would be increased by a factor of two or more in below-normal and dry years. Summer flows would be increased from little or nothing under the existing condition to a steady 7 cfs under the proposed project.

Another approach to analyzing the modeling data is shown in Table 4.6.21, which summarizes the estimated annual average volume of water that flows down Alameda Creek downstream of its confluence with Calaveras Creek in different year types under the existing condition and with the proposed project. The proposed project would decrease the annual average volume of water flowing down Alameda Creek downstream of the confluence in wet and above-normal years by 7 percent and 16 percent, respectively, and it would increase the annual average volume of water flowing down the creek in normal years by 12 percent. In below-normal and dry years, an annual average of between 5,800 and 6,400 AF would flow down the creek, a 487-percent and 1,937-percent increase, respectively, compared to the existing condition.

The proposed project would increase long-term annual average flows in all year types by 3 percent, as shown in Table 4.6.21. Under the existing condition, long-term annual average flows in Alameda Creek downstream of its confluence with Calaveras Creek are 22,010 AF; with the proposed project, they would be 22,680 AF.

Table 4.6.20: Estimated Average Monthly Flow in Alameda Creek Downstream of Calaveras Creek Confluence (cubic feet per second)

Month	Wet	Above-normal	Normal	Below-normal	Dry	All
Existing Condition (2005)						
Oct	0	0	0	0	0	0
Nov	1	1	0	0	0	1
Dec	56	25	23	1	0	21
Jan	280	114	24	3	1	84
Feb	462	214	56	6	2	147
Mar	272	110	26	7	1	83
Apr	144	25	5	1	1	35
May	5	2	1	1	0	2
June	1	0	0	0	0	0
July	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sept	0	0	0	0	0	0
With Proposed Project (2018)						
Oct	7	7	7	7	7	7
Nov	5	5	5	5	5	5
Dec	45	20	16	5	5	18
Jan	201	60	18	14	14	61
Feb	426	141	34	22	21	128
Mar	270	108	25	21	17	88
Apr	146	32	9	7	7	40
May	10	7	7	7	7	8
June	7	7	7	7	7	7
July	7	7	7	7	7	7
Aug	7	7	7	7	7	7
Sept	7	7	7	7	7	7
Difference and Percent Change, Existing Condition (2005) vs. Proposed Project (2018)						
Oct	7	*	7	*	7	*
Nov	4	[400%]	4	[400%]	5	*
Dec	-11	[-20%]	-5	[-20%]	-7	[-30%]
Jan	-79	[-28%]	-54	[-47%]	-6	[-25%]
Feb	-36	[-8%]	-73	[-34%]	-22	[-39%]
Mar	-2	[-1%]	-2	[-2%]	-1	[-4%]
Apr	2	[1%]	7	[28%]	4	[80%]
May	5	[100%]	5	[250%]	6	[600%]
June	6	[600%]	7	*	7	*
July	7	*	7	*	7	*
Aug	7	*	7	*	7	*
Sept	7	*	7	*	7	*

Note:

* Indicates an increase from zero under current conditions. Detailed information on the HH/LSM and underlying assumptions is provided in Appendix D.1 of this document and the WSIP Final Program Environmental Impact Report (WSIP PEIR Appendix H) and Response to Comments.

Source: SFPUC 2009

Table 4.6.21: Existing and Estimated with-Proposed Project Average Annual Flow in Alameda Creek Downstream of Its Confluence with Calaveras Creek

Year Type	Flow (AFY)		Difference (Proposed Project – Baseline)	
	Existing	Proposed Project		
Wet	72,361	67,329	-5,032	-7%
Above-normal	29,007	24,258	-4,749	-16%
Normal	8,022	8,995	973	12%
Below-normal	1,195	7,018	5,824	487%
Dry	328	6,681	6,353	1,937%
All years	22,010	22,680	671	3%
<i>Note:</i> AFY = acre-feet per year.				

Source: SFPUC 2009

In summary, implementing the proposed project would alter the pattern of flow in Alameda Creek downstream of its confluence with Calaveras Creek by decreasing wintertime flow in wet, above-normal, and normal years. It would increase flow in the creek at all other times. The decrease in wintertime flow in wet, above-normal, and normal years is attributable to the restoration of capacity in Calaveras Reservoir, which would enable the SFPUC to capture a greater proportion of wintertime runoff from Alameda Creek, Arroyo Hondo, and upper Calaveras Creek. The increase in flow at all other times is attributable to the proposed fisheries releases made from the ACDD and Calaveras Reservoir and implementation of the ACDD Operations Plan.

Impact Conclusion

Flow in Alameda Creek downstream of its confluence with Calaveras Creek would reflect the proposed project-caused changes in flow in Alameda Creek downstream of the diversion dam and in Calaveras Creek downstream of Calaveras Reservoir. Wintertime flows in Alameda Creek downstream of the confluence in wetter year types would be less than under existing conditions. Flow in the creek in the summer months would be increased and would never fall below 7 cfs.

The flow regime in Alameda Creek downstream of its confluence with Calaveras Creek with the proposed project in place would be substantially similar to the existing flow regime. Flows would be greatest in the winter months of wetter years, and flows would be small in the summer months of all years and the winter months of drier years. Peak flows, though reduced at some times, would be similar to those under the existing condition and could be increased when uncontrolled spills occur over the Calaveras Dam spillway. In contrast with the completely dry conditions that occur at times, with the proposed project, there would always be some flow in

Alameda Creek downstream of its confluence with Calaveras Creek. The proposed project would not substantially change the range of flows in Alameda Creek downstream of the confluence, with the exception of the elimination of completely dry conditions in summer, which would be beneficial and the passage of peak flow events due to implementation of the ACDD Operations Plan. Thus, the proposed project would have a less-than-significant impact on flow in Alameda Creek downstream of its confluence with Calaveras Creek.

This significance determination differs from the determination of a significant and unavoidable impact on hydrology in the WSIP PEIR (WSIP Impact 5.4.1-2). The reasons for that determination were previously explained under Impact 4.6.5: The PEIR identified that flows downstream of the ACDD were predicted to decrease in wet, above-normal, and normal years and remain unchanged in below-normal and dry years, with an overall reduction in flows over all year types. Further, it was presumed that peak flows would dramatically change, with the elimination of low and moderate flows and a substantial reduction of higher flows.

As explained earlier under Impact 4.6.5, the primary reason for the different conclusion in this analysis is that with the proposed project as currently configured, more water would flow down Alameda Creek downstream of the diversion dam than was assumed to be the case with the proposed project as configured in the WSIP PEIR. The project as now proposed includes an ACDD Operations Plan and contains a bypass component and operational feature in which fisheries releases would be made from the proposed ACDD bypass rather than from Calaveras Reservoir, as assumed in the PEIR. The HH/LSM modeling analysis presented above accounts for these project changes. As explained above, under the proposed project as now configured, only average annual flows in above-normal and normal years result in a reduction in flows in Alameda Creek downstream of the ACDD, and, as further explained, when flows downstream of the confluence of Alameda Creek and Calaveras Creek are considered, the overall effect is a reduction in wet years of 7 percent and above-normal years of 16 percent but an increase of 12 percent in normal years along with substantial increases in below-normal and dry years and an increase over all years of 3 percent.

Further, the WSIP PEIR analysis assumed that peak flows from major storms would resemble those currently occurring during much smaller storm events and that smaller storms would not result in any flows at all. The HH/LSM modeling and the assessment of peak flow events using the USGS 15-minute gage data, along with results from the HH/LSM, present a more refined picture of what would occur downstream of the ACDD during peak flow events. The analysis of 15-minute gage data and the ACDD Operations Plan shows that with the project as proposed, peak flows are not entirely diverted. As explained previously, even during times when increased diversions are predicted by the model compared to the baseline condition, peak flows resembling small and large storms would continue to spill over the ACDD.

In sum, the proposed project would not substantially change the range of flows experienced by Alameda Creek downstream of the confluence, with the exception of the elimination of completely dry conditions in the summer, which would be beneficial. Thus, the proposed project would have a less-than-significant impact on flow in Alameda Creek downstream of its confluence with Calaveras Creek.

Impact 4.6.7: Operational effects on flow in Alameda Creek downstream of the Arroyo de la Laguna confluence.

Operation of the CDRP and the ACDD have the potential to alter the hydrology of Alameda Creek downstream of the Arroyo de la Laguna confluence. Alameda Creek downstream of this confluence is considered separately from the previous impact analysis due to the substantial flow contribution to Alameda Creek from Arroyo de la Laguna and the resulting dampening of operational changes in upper Alameda Creek. Flow in Alameda Creek downstream of the Arroyo de la Laguna confluence includes water flows from the project watershed as well as flow from the northern watershed which includes the Arroyo Mocho, Arroyo Del Valle, and Arroyo de la Laguna tributaries.

Project Watershed Contribution

The flow in Alameda Creek upstream of the confluence of Arroyo de la Laguna is a function of: (1) flows arriving at the confluence of Alameda and Calaveras Creeks, which are dependent on releases from Calaveras Dam, bypass flows or flow spilled past the ACDD, and the unregulated runoff occurring between the confluence and the diversion dam and Calaveras Dam, (2) unregulated runoff from the Sunol Valley watershed, and (3) flow entering Alameda Creek from San Antonio Creek, which is regulated by releases from Turner Dam. In addition, Alameda Creek can seasonally either lose (dry season) or gain (rainy season) flows to and from groundwater and the gravel pits in the Sunol Valley reach of Alameda Creek.

In addition to the flows identified above, another WSIP project is proposed for the reach of Alameda Creek in the vicinity of the San Antonio Creek confluence that would affect the amount of flow in the creek at the Arroyo de la Laguna confluence and downstream. The UACFGP would recover up to 20 cfs of the MOU flows bypassed from the ACDD and released from Calaveras Dam. Impacts on the reach of Alameda Creek between the proposed site of the UACFGP and Arroyo de la Laguna (approximately 1.7 miles) are discussed briefly in Section 6.2, Cumulative Impacts, in Chapter 6, Other Topics Required by CEQA; they are not explored further in this section because the impacts would be a result of a separate project. The analysis of impacts on lower Alameda Creek described below does, however, include the predicted reductions in flow from the UACFGP because that project is part of the WSIP, and the system modeling using the HH/LSM cannot disaggregate this project from the future condition.

As such, the following discussion regarding impacts to lower Alameda Creek represents a conservative case. Without the UACFGP, flows released from the ACDD and Calaveras Dam to satisfy MOU flow requirements would continue down Alameda Creek into lower Alameda Creek, resulting in higher flows with just the project implementation and less change from the baseline condition.

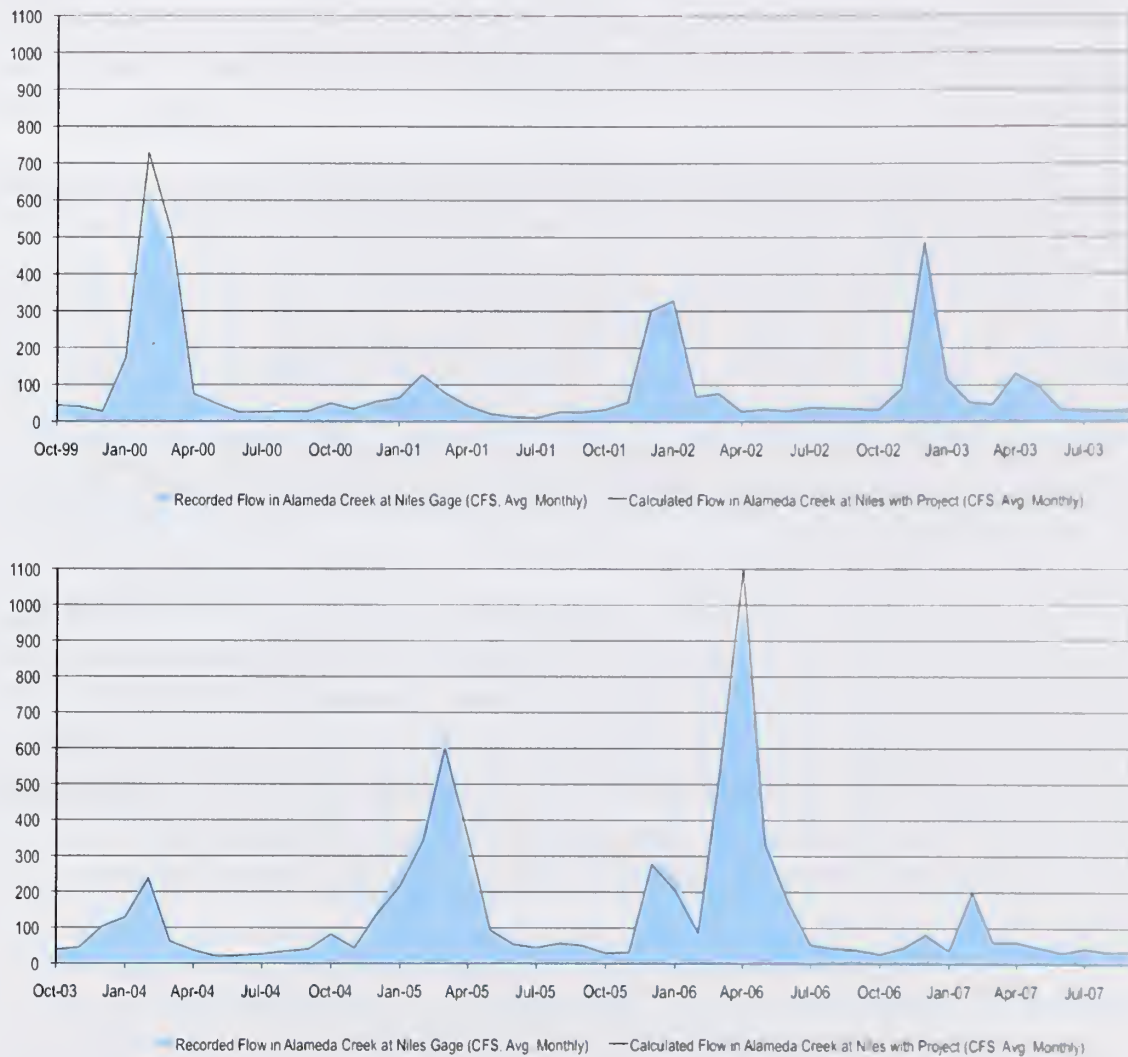
Downstream of the confluence of Alameda and San Antonio Creeks, Alameda Creek joins with the other major tributary in the Alameda Creek watershed, Arroyo de la Laguna. Downstream of this confluence, Alameda Creek enters Niles Canyon and flows for approximately 3.5 miles before exiting the canyon. Lower Alameda Creek, which begins downstream of the Niles Canyon reach, is a low-gradient creek characterized by flood control channels and several instream structures, including the BART weir and ACWD inflatable dams used for water diversion. The ACWD utilizes the lower creek for water supply via diversions and groundwater recharge. Lower Alameda Creek ultimately discharges into San Francisco Bay approximately 12 miles downstream of Niles Canyon.

An analysis of recent USGS flow records and HH/LSM-predicted changes in flow with project implementation was performed to estimate how the project's implementation would affect flows in lower Alameda Creek in the vicinity of Niles. The analysis methodology is outlined in Appendix D.3. The gage analysis was performed for Water Years 2000–2007 and revealed that for that period, approximately one-third of the flow in Alameda Creek at Niles resulted from the upper Alameda Creek watershed. The remainder of the flow resulted from the Arroyo de la Laguna watershed (55 percent) and watershed near the mouth and within Niles Canyon (13 percent).

Since all SFPUC operations occur within the upper Alameda Creek watershed, implementation of the project would only affect approximately one-third of the upstream flow that contributes to flow at the Niles gage. As such, flow changes in upper Alameda Creek as a result of the project would be dampened in lower Alameda Creek by inflow from the Arroyo de la Laguna and Niles watersheds. For instance, a flow of 100 cfs in upper Alameda Creek could hypothetically be reduced by 25 percent in a given month with the project, resulting in a flow of 75 cfs for Alameda Creek upstream of Arroyo de la Laguna. The same hypothetical flow in Alameda Creek at the Niles gage would be 300 cfs without the project and 275 cfs with the project, corresponding to an 8 percent reduction.

Figure 4.6.16, Comparison of Average Monthly Flow at the Niles Gage, Recorded Flow versus Flow with Proposed Project, presents the predicted changes in flow in Alameda Creek at the Niles gage over the 8-year period (2000–2007) with implementation of the proposed project. The solid blue area in Figure 4.6.16 represents average monthly flow at Niles, and the black line indicates

Figure 4.6.16: Comparison of Average Monthly Flow at the Niles Gage, Recorded Flow versus Flow with Proposed Project



Notes:

- With project conditions includes recapture of MOU flows released from ACDD and Calaveras Dam.
- Years 2000 and 2001 analysis includes a comparison of Base with Calaveras Up vs WSIP Proposed Program. DSOD restriction was implemented in 2001 with Calaveras Reservoir level reduction beginning in WY 2002.
- Analysis for WSIP only, no other cumulative projects analyzed.

Sources: SFPUC 2009; USGS 2009e, USGS 2009f, USGS 2009g

calculated flow with implementation of the project. The discrepancy between the two lines represents a change between gage records and calculated flow under the proposed project.

The analysis shows that based on the hydrology from 2000 to 2007, reductions in flow in Alameda Creek at Niles Canyon would occasionally occur under implementation of the project. Reductions of up to 17 percent in average monthly flow could occur in years similar to Water Years 2000–2007. The maximum flow reduction would occur during January of an above-normal year and reductions would generally occur in the December to March timeframe of normal, above-normal, and wet years. The 2000 to 2007 period includes four of the five hydrologic year types (only a wet year is absent). However, as noted in the previous impact discussions, the greatest flow reductions resulting from implementation of the project would occur during normal and above-normal years, which are represented in the 2000–2007 data and the most significant flow reductions are therefore included in this analysis.

Impact Conclusion

Flow in Alameda Creek downstream of the confluence of Arroyo de la Laguna would be altered as a result of implementation of the proposed project in winter months of normal or wetter years; however, the change in flows would be substantially dampened by inflows from Arroyo de la Laguna and would not result in flows outside the range historically experienced in lower Alameda Creek. Reductions would occur in December through March of normal and wetter years, while flows in April and May of those year types would generally increase, with the exception of a slight decrease in April of wet years and May of above-normal years. Below-normal years would experience a slight decrease in February and slight to moderate increases in April. The remainder of months in all year types, including all months of dry years, are not expected to experience a change in flow from existing conditions with implementation of the project.

As explained previously, implementation of the project alone without the UACFGP could not be quantitatively analyzed because no model exists for this scenario. However, the SFPUC has committed to implementing MOU releases from the ACDD and Calaveras Reservoir upon completion of the CDRP regardless of whether the UACFGP has been implemented. Under the scenario where MOU flows are not recaptured by the UACFGP, the additional flows would continue down Alameda Creek into the reach downstream of Arroyo de la Laguna, resulting in less wintertime reduction of flow in normal and wetter years and slight increases in flow at other times of all years in lower Alameda Creek.

The calculated flows for lower Alameda Creek with implementation of the project (both with and without the UACFGP) are within the range of current flows in this segment of the creek. Further, the flood control infrastructure and water supply facilities in lower Alameda Creek were constructed and operational well before the current DSOD restriction on Calaveras Reservoir required the SFPUC to reduce its diversions at the ACDD. Therefore, implementation of the

project would not affect the operation of flood control infrastructure and water supply facilities in lower Alameda Creek.

Implementation of the proposed project and the UACFGP would represent an incremental decrease in flows in winter months of normal or wetter years in lower Alameda Creek; however, the anticipated decreases would not substantially alter the hydrology outside the range of flows experienced in this portion of the creek. Implementation of the proposed project without the UACFGP, while not quantified, would result in less wintertime flow reductions and slight increases during most other months in lower Alameda Creek than predicted by the modeling presented in this impact discussion. Therefore, hydrology would be altered to a lesser degree with implementation of just the project without a recapture facility. Therefore, impacts on flow in Alameda Creek downstream of the confluence of Arroyo de la Laguna with implementation of the CDRP would be less than significant.

Impact 4.6.8: Downstream flooding and hazard in the event of dam failure.

Calaveras Reservoir does not now and would not in the future have a primary flood control function. Under existing conditions, there is abundant, temporary, incidental, emergency storage capacity resulting from the DSOD-restricted water level. Although the reservoir level can rise over the required pool elevation during a storm, DSOD requires that the water level be reduced rapidly to Elevation 705 feet by releases to the SVWTP and cone valve releases. This existing capacity for temporary storage during flood conditions would be replaced by water supply storage to the proposed higher pool level. Thus, compared to existing conditions, the long-term operation of the reservoir would result in reduced capacity for retaining incidental flood storage on a temporary basis. However, as in the past, Calaveras Dam would provide similar incidental flood protection by capturing or holding back some streamflow during major storms, and there would be no requirement to release the water rapidly. Instead, the spillway itself would regulate the reservoir water level and ensure that the pool is kept to a safe level. SFPUC would release water through the cone valve as an operational action and under most circumstances likely would use the cone valve for this purpose. Releases through the cone valve or by spills into Calaveras Creek would be expected in wetter years, particularly if a major storm were to occur when the reservoir was already filled to near its target pool level. In such situations, there would be little remaining storage capacity, and a cone valve release or spill would be necessary. The proposed spillway is designed to accommodate flows up to 39,700 cfs, although such an event would be highly unlikely to occur. The historical maximum spill (in 1958) was 5,813 cfs, but average daily spills tended to range at about 400–600 cfs (see Table 4.6.11, Historical Calaveras Reservoir Spillway Releases).

In a spill or controlled release event, because there would be some time required for the reservoir capacity to be filled and to reach spill elevation, Calaveras Reservoir would function to delay the release. This lag time in many instances would delay the releases until after the peak flows

generated in the watershed had passed. Although peak flows downstream of the reservoir would be reduced or delayed as a result, the period of high flow would be attenuated by the cone valve release or spill. Even if considered an incidental effect, this would be a beneficial effect on downstream flood conditions and would reduce the flood hazard related to peak flow. Although the benefit would be reduced compared to existing conditions, it would remain an incidental benefit for flood hazard downstream.

Cone valve releases generally would be expected to be made in advance of a spill. (In fact, its operation would be for the specific purpose of avoiding a spill.) Cone valve releases would occur more frequently than spills; however, they would occur less frequently than under baseline conditions. Cone valve releases would be needed either for conditions of major storms that are of lesser intensity than those making a spill necessary or for conditions in which the reservoir pool level already was high at the onset of a storm for which even a moderate inflow would make a release necessary. Cone valve releases without a coincident spill would have a relative ameliorating effect on peak flows because of the upper limit on controlled releases created by the size of the cone valve (approximately 1000 cfs upper limit). As with spills, cone valve releases may extend high flows downstream in Calaveras Creek past the peak flow occurring in the watershed. For this reason, the effects are considered in net to be beneficial to reducing downstream flood hazard as related to peak flood conditions.

Operation of the ACDD would remove up to 650 cfs from flows of upper Alameda Creek. During large storm events, a reduced flow over the dam could result, depending on the hydrograph of the storm, including reduced peak flow. Reduced peak flow in the creek downstream of the dam would have the effect of reducing the flood hazard downstream associated with peak flows. As a result, operation of the diversion would have a beneficial effect on flood hazard.

MOU flows would occur at low flow rates and therefore would have no discernible effect on flood flows or flood hazard.

Sedimentation of the reservoir would gradually further reduce the reservoir storage capacity over time, thereby diminishing its incidental flood control benefits. If the reservoir becomes fully filled with sediment in the distant future, all incidental benefit for flood hazard reduction would be lost. This effect is part of the existing condition and would occur regardless of the proposed project.

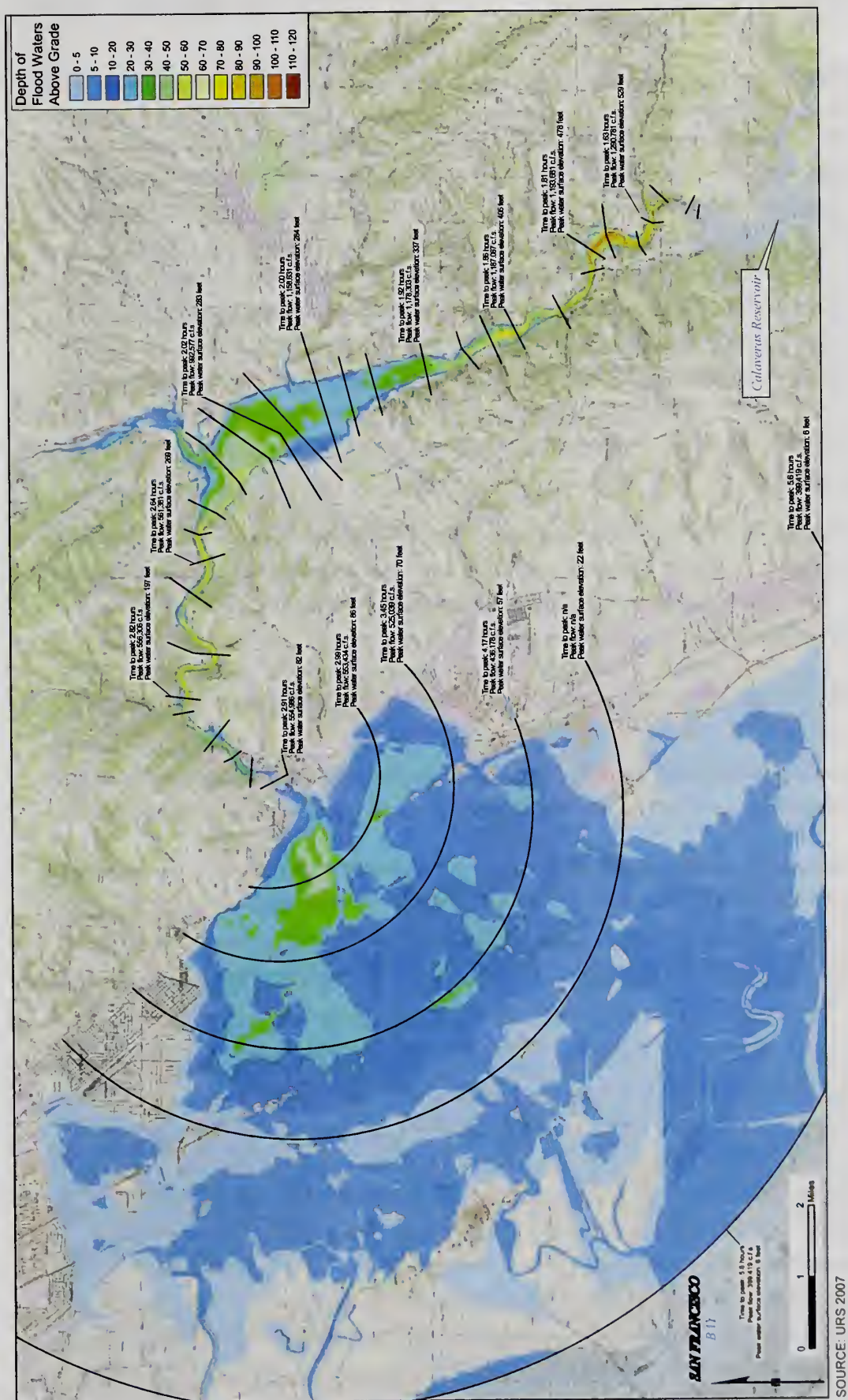
The proposed project would increase the allowable storage volume of Calaveras Reservoir, increasing the volume of water stored behind the dam and therefore increasing the downstream area that would be inundated if the dam were to fail. The proposed project would increase the storage in Calaveras Reservoir nearly threefold over existing conditions, from 38,100 AF to 96,850 AF. The larger volume of water would pose a greater hazard to downstream areas from

inundation should the dam fail, and would affect a greater area downstream of the dam than would be inundated if the existing dam with restricted storage were to fail.

The inundation zone downstream from Calaveras Reservoir that could be flooded in the event of a dam failure was last updated in May 2007 (URS 2007). This Dam Break Analysis of the proposed dam and reservoir operation addressed a hypothetical failure of the Calaveras Dam and resulting downstream inundation. Assuming a net reservoir storage capacity of 92,000 AF (i.e., a full reservoir, reduced from original capacity of 96,850 AF by sediment accumulation), this study mapped the area of flood inundation due to an initial piping failure (water forming a pathway through the earth materials of the dam) that would result in a peak outflow of 1.3 million cfs. The inundation map shows the limit of inundation starting from Calaveras Dam and stretching to San Francisco Bay (see Figure 4.6.17: Depth of Floodwaters from Modeled Breach of Calaveras Dam). In the case of catastrophic dam failure, floodwaters from Calaveras Reservoir are predicted to travel along Calaveras Creek and reach the confluence with Alameda Creek. Floodwaters would then continue along Alameda Creek and spread across the Sunol Valley. Entering the constrained Niles Canyon reach, floodwaters would continue along Alameda Creek and exit the canyon within the City of Fremont. Floodwaters would then spread across the Niles Cone and the communities of Fremont and Niles. The Quarry Lakes would be affected, and I-880 would be flooded. Floodwaters would eventually reach the communities of Newark and Union City. Floodwaters are estimated to travel from Calaveras Dam to urban areas along San Francisco Bay in 4–5 hours.

The proposed design of the dam would decrease the risk of failure in an earthquake when compared with the existing structure. The proposed project would be designed to withstand both the maximum credible earthquake (MCE) and probable maximum flood event (PMF). The proposed spillway would have a greater capacity to pass spill flows than the existing spillway. The proposed design would accommodate an uncontrolled release of 39,700 cfs. The PMF flow is far greater than the highest spill on record. The replacement dam would be designed and constructed under stringent and conservative guidelines and criteria and is intended to enhance dam stability and safety by replacing the existing dam with a dam designed to withstand the seismic forces of the site and overtopping forces due to flood events.

The proposed dam would be designed to withstand the run-up effects of an earthquake-induced seiche wave. Assuming the maximum credible earthquake (moment magnitude 7 ¼) on the Calaveras Fault, a seiche wave up to 7.4 feet would be generated in the reservoir. This seiche wave height is less than the 16 feet of freeboard, and thus the wave would not top the crest. Additionally, the riprap surface of the dam would remain stable from the waves (URS 2009).



**FIGURE 4.6.17: DEPTH OF FLOODWATERS FROM
MODELED BREACH OF CALAVERAS DAM**

Impact Conclusion

The proposed project would increase the DSOD-allowable storage capacity of Calaveras Reservoir compared with the current DSOD-restricted level. As a result, the existing incidental capacity to accommodate large storm event inflow would be reduced, and the incidental benefits of reduced flood levels downstream in Alameda Creek would be reduced commensurately. Nonetheless, the effect would remain beneficial because the proposed project is designed to withstand the probable maximum flood and provide for operations that allow storage of winter storm events that would reduce flood hazards downstream of the reservoir. The operation of the ACDD would divert more flows during some storm events (up to 650 cfs during storm peaks) than are diverted now; the extent of any diversion would depend on the hydrographs of individual storms. As a result, associated flood hazard downstream in Alameda Creek would be somewhat reduced; this impact would be beneficial.

The increased storage in the reservoir could be a source of additional downstream floodwaters in the event of dam failure; however, the seismic and flood design considerations incorporated into the project would reduce the risk of dam failure when compared with the existing structure. Therefore, the impact would be less than significant.

Impact 4.6.9: Effects on channel formation and sediment transport along Calaveras Creek.

Proposed operation of the dam would continue to trap almost all sediment transported into the reservoir. This condition already exists, and no change is anticipated because of the project.

Under existing conditions, water is released from the reservoir through the cone valve to manage reservoir storage levels and for periodic valve testing; the spillway has not been used during the DSOD-restricted period of operation. The operation of the proposed project would manage reservoir storage levels through use of a new spillway and, with reduced frequency and duration, the cone valve.

The historical maximum spill (in 1958) was 5,813 cfs, but average daily spills, when they occur, are in the range of 400–600 cfs (see Table 4.6.11); these flows are comparable to cone valve releases during the DSOD-restricted baseline (see Table 4.6.12). Releases over the spillway would be directed into the spillway channel and stilling basin such that the flow energy of the spill (and related erosion potential) would be substantially reduced before discharging into Calaveras Creek. It is assumed that the cone valve would already be operating before a spill would occur such that the spill and cone valve releases would be a combined discharge into the creek. The resulting flows in Calaveras Creek would be greater than any that have occurred during the baseline period. However, the potential channel-forming flows with the project would be similar to those that occurred under historical operation.

Water released from the cone valve or spilled from Calaveras Dam would be expected to contain little more than suspended fine sediment because releases and spills would consist of low-turbidity water drawn from the higher level in the pool. High flows of low turbidity water have the potential to induce scour of the bed and potential bank erosion. Available sediment (including coarse sediment) could be mobilized and transported downstream. However, a change in creek morphology and sediment conditions would not be expected because the geomorphic effects of scour and incision already have occurred in Calaveras Creek downstream of the dam as a result of decades of similar water releases during spills and cone valve discharges. The operation of Calaveras Dam already has substantially altered the sediment source material and transport conditions of Calaveras Creek downstream of the dam such that proposed operation of the CDRP would not result in a substantial change in stream morphology in Reach C-1. Coarse sediment trapped in the reservoir would continue to be unavailable to the creek. The proposed releases would not be expected to change existing channel morphology. Therefore, sediment transport in Calaveras Creek below the dam would be similar to baseline and historical conditions.

Impact Conclusion

The replacement dam would continue to be a sediment trap for all bed load and most suspended sediment derived from the watershed upstream of the reservoir. Potential downstream channel-forming flows with the project would be similar to those that occurred under the baseline and during historical operation. A change in creek morphology and sediment conditions is not anticipated. Because substantial change would not occur, the impact would be less than significant.

Impact 4.6.10: Effects on channel formation and sediment transport along Alameda Creek downstream of the ACDD to the Calaveras Creek confluence.

As discussed above, operational changes as a result of implementation of the project would resume operations at the ACDD similar to pre-DSOD conditions that have been in place for more than 70 years. Current geomorphic characteristics of the stream channel downstream of the ACDD have been influenced since construction of the ACDD in 1931. Since that time, flow in Alameda Creek downstream of the diversion dam has been regulated by diversions through the Alameda Creek Diversion Tunnel to Calaveras Reservoir. Before the DSOD restriction on operation of Calaveras Reservoir (2001), the SFPUC operational procedure was to divert flows of up to 650 cfs from Alameda Creek upstream of the diversion dam to Calaveras Reservoir for most of the wet season and annually sluice/flush sediment from behind the diversion dam into the downstream reach of Alameda Creek.

Since implementation of the DSOD restriction, the frequency and duration of diversions have become more variable, with reduced overall diversions to Calaveras Reservoir, particularly during wetter years. This has resulted in more net flow in Alameda Creek downstream of the

diversion dam as compared to the unrestricted pre-DSOD condition and high peak flows during those years when no diversions were made during the winter/springs months (2005 and 2006). However, the duration of the DSOD-restricted baseline period is insufficient to establish a meaningful change to stream geomorphology when compared to the pre-DSOD restricted conditions.

Implementation of the proposed project would result in changes in flow and sediment transport rates downstream of the ACDD compared to some years in the DSOD-restricted period (i.e., compared to periods when diversion were not being made). However, natural peak flows in excess of 650 cfs, in addition to the provision of MOU bypass flows, would partly maintain the natural dominant discharge of the creek.

The annual sluicing procedure performed to remove sediment behind the ACDD would continue to deliver sediment downstream of the diversion dam. Additionally, operation of the ACDD under the proposed project would result in the continued occurrence of peak flows. These peak flows would continue to occur and would be anticipated to maintain sediment transport and channel form.

Thus, with respect to diversion dam operations, the CDRP would represent a return to some characteristics of historical operations, such as diversion of intermediate and high flows on a more regular basis. Operation of the ACDD with the project would include the continued passing of periodic peak flows, bypass flows providing base flow downstream, continued sluicing of sediments past the dam, and an operations plan to minimize unnecessary diversions. These conditions would be anticipated to maintain geomorphic processes that are important for the maintenance of channel form.

Impact Conclusion

In summary, channel shape, sediment characteristics, and sediment transport in Alameda Creek downstream of the ACDD have been largely influenced by the historical operation of the diversion dam. Potential downstream channel-forming flows with the project would be similar to those that occurred under the baseline and during historical operation. A substantial change in channel-forming flows and sediment conditions is not anticipated. Because substantial change would not occur, the impact would be less than significant.

Impact 4.6.11: Effects on channel formation and sediment transport along Alameda Creek downstream of the Calaveras Creek confluence

Downstream of the confluence of Calaveras Creek and Alameda Creek, sediment transport is the combined result of sediment supply and flow conditions generated by each creek. Under the project operations, as described previously, Calaveras Creek (as at present) would supply minimal sediment, and flows would be related to spills and cone valve releases. Also, MOU flow releases

would occur (none occur at present), but these would be anticipated to have minimal effect on sediment transport.

Under the proposed project, operation of the ACDD on Alameda Creek would include the continued passing of periodic peak flows and continued sluicing of sediments, along with MOU bypass flows, providing base flow downstream; a substantial change in creek morphology and sediment conditions is not anticipated.

Similar to baseline and historical conditions, under the proposed project, predominant sediment load would be generated by Alameda Creek, whereas the flows needed to transport that sediment downstream of the confluence would be related to the flows in both creeks. Under the proposed project, high flows over the ACDD typically would occur at the same time that spills and/or cone valve releases would occur at Calaveras Dam. During such events, high sediment load would be provided from Alameda Creek, and the combined flows from both creeks would generate high flows capable of transporting sediment. Large sediment movement may be generated by such conditions in downstream reaches of Alameda Creek.

Net movement of sediment through Alameda Creek to the confluence with the Arroyo de la Laguna would largely depend on high flows, similar to existing and historical conditions. Similarly, downstream of the confluence with the Arroyo do la Laguna, potential channel-forming flows and sediment transport with the project would be similar to those that occurred under the baseline and during historical operation. Although the processes may be influenced by the project, they are not expected to result in a substantial change to sediment transport and channel formation downstream of the confluence of Calaveras Creek and Alameda Creek.

Impact Conclusion

In summary, channel-forming flows and sediment transport in Alameda Creek downstream of the confluence with Calaveras Creek have been influenced by the historical operations of Calaveras Dam and the ACDD. Potential downstream channel-forming flows with the project would be similar to those that occurred under the baseline and during historical operation. A substantial change in channel-forming flows and sediment conditions is not anticipated. Because substantial change would not occur, the impact would be less than significant.

Impact 4.6.12: Changes in groundwater levels, flows, quality, and supplies.

Compared to current conditions, the refilling of the reservoir would increase groundwater levels around the perimeter of the reservoir. The proposed dam also would result in continued small base flow beneath the dam. The small amount of subflow in Calaveras Creek downstream of the dam is not significant itself, but would contribute to the continued support of riparian vegetation along Calaveras Creek.

The diversions at the ACDD and storage in the reservoir under the proposed project would reduce some peak and moderate flows in Alameda Creek between the ACDD and San Francisco Bay. Seasonally, the proposed project would reduce flows in the high-flow months of normal and wetter years and increase flows in the low-flow months and all months of below-normal and drier years due to fishery releases. The impact of these changes in the seasonality of flow would be a slight increase in the volume of flow in Alameda Creek on an average annual basis. The overall effect of these changes on groundwater supplies along Alameda Creek in the Sunol Valley would be minimal. As noted, the groundwater in these areas is not used as a water supply. However, the modest increase in groundwater derived from the bypass flows may have importance to maintaining riparian habitat.

Operation of the project would raise groundwater levels in the vicinity of the dam to those typical of the pre-DSOD restrictions (i.e., pre 2001). In the Sunol aquifer areas, the impact of the project is expected to be minor (either slightly positive or slightly negative), depending on the year's rainfall and seasonal conditions. As noted in previous impact discussions, flow in Alameda Creek through the Sunol Valley would be reduced in wet and above-normal years, slightly elevated in normal years and substantially increased in below-normal and drier years. Given that the net effect of these flow changes would be a slight increase in average annual flow in Alameda Creek, the proposed operation of Calaveras Dam and the ACDD would likely have little effect on groundwater levels when compared with existing conditions. As such, the impact of the proposed project on groundwater levels in the Sunol Valley would be less than significant.

Downstream of the Sunol Valley, Alameda Creek recharges the Niles Cone Aquifer. As discussed under Impact 4.6.7, wet weather flows in lower Alameda Creek would be reduced compared to the current baseline and increased in comparison to historical conditions (pre-DSOD restriction) in place at the time of the construction of the diversion facilities in lower Alameda Creek.

Impact Conclusion

Operation of the proposed Calaveras Dam would not bring about a substantial change from historical groundwater conditions in the vicinity of the dam or in the Sunol Valley. Thus, this impact would be less than significant. Impacts on groundwater in the Niles Cone Aquifer would be less than significant with the implementation of the proposed project because flows in Alameda Creek downstream of Niles Canyon that recharge the Niles Cone Aquifer would be maintained within a range of flows experienced since the Niles Cone Aquifer began to be managed and utilized as a water supply resource. The project's minor changes in groundwater levels would not affect groundwater quality. This impact would be less than significant.

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